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Saturday Review of THE SCIENCES

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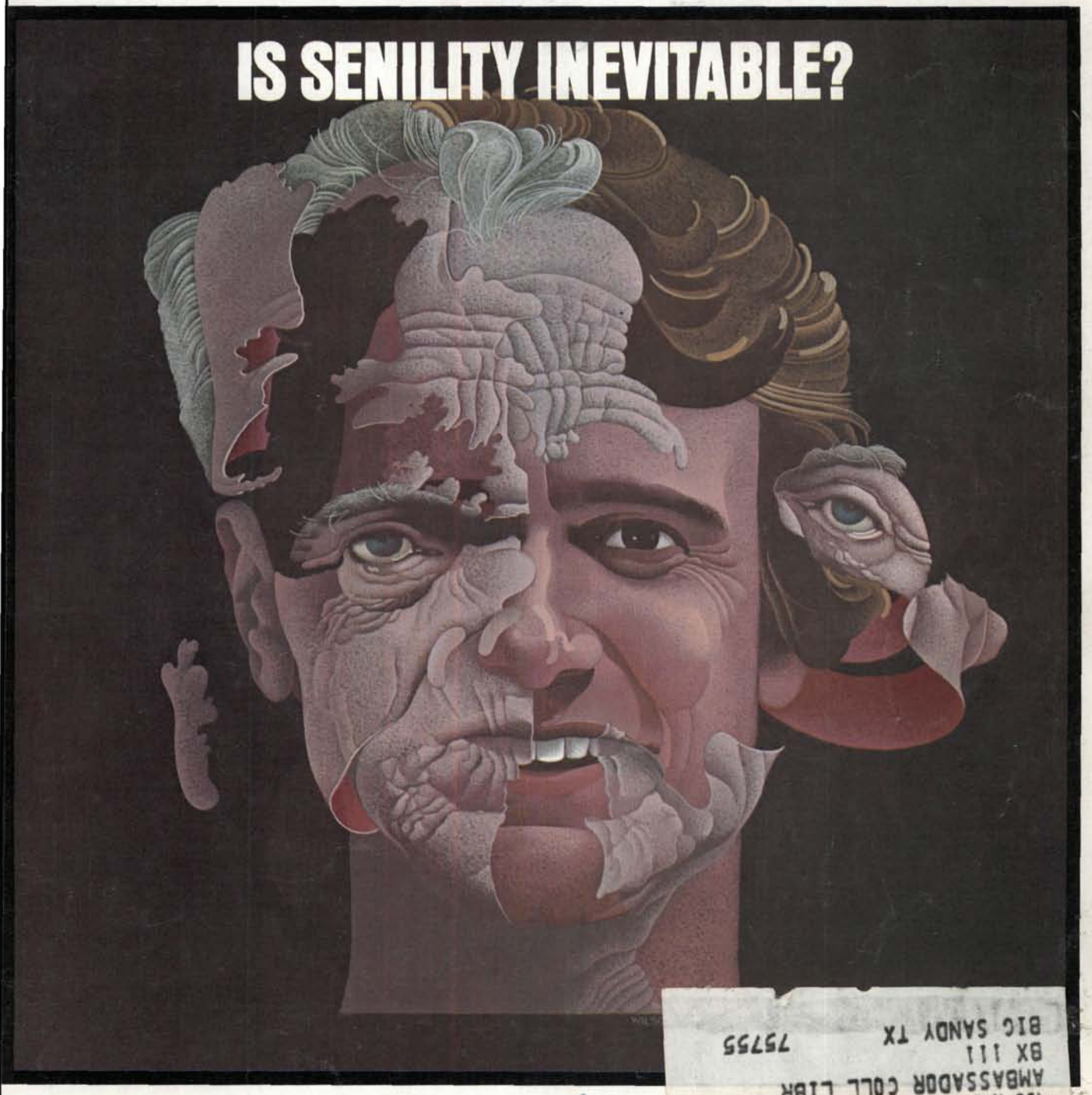
Electronic Alligators • The Benefits of Burning



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Caprice Coupe at Newport Beach, California.

Take a second to buckle up. It could save a life

New Caprice. If you're just plain tired of just plain driving

There was a time when Chevrolet stood for economy and dependability because that was what people wanted most in the cars they drove.

But, of course, people change, ideas change, and Chevrolet believes that there's always a better way.

We decided to blend all that we had learned about economy and dependability with luxury in a car called Caprice. Five years ago we had one model. Today, we have five.

They all come with power steering, power front disc brakes, automatic transmission and 400-cu.-in. V8.

They all come with yards of insulation to help keep the ride quiet.

They all come with an advanced power ventilation system that includes a delay sensor to help avoid cool drafts on cold mornings.

They all come with an improved front bumper syste molded full-foam seats, a d tinctive grille unlike any oth Chevrolet's, new colors, ne fabrics and one of the mo comfortable steering whee you've ever taken hold of.

Plus you can choose from list of luxury options in keepi with the car.

So if you're just plain tir of just plain driving, we thi we've got just the car for yo Caprice.

The Caprice luxury line also now includes the 4-door sedan, sport sedan, convertible and estate wagon.

Chevrolet

1973 Chevrolet. Building a better w to see the U.S.A.

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FREE MONEY!

It's a safe bet that you, like the average American, are completely unaware of the incredible bonanza recently granted you by Congress in the form of whopping new Social Security benefits.

Item: When today's average worker of 22 retires, he and his wife, according to Social Security actuaries, will receive an annual pension of *$38,000*. Moreover, the total amount of Social Security he and his wife can expect to collect *will surpass half a million dollars!*

Item: The average American doesn't know it, but the single most valuable asset he now possesses is his Social Security. It is equivalent, in maximum brackets, to a guaranteed 5% income on cash in bank, stocks or real estate worth *over $100,000*. Moreover, every cent of this bounteous income is *TAX FREE!*

Item: Most Americans still believe, mistakenly, that Social Security is a dole exclusively for the aged. The fact is, however, that *10 million* Americans under the age of 60 (and averaging a mere 30) are now collecting Social Security. These non-old age pensioners receive *$13 billion* annually, and both their number and the amounts of money they collect are bound to increase in years ahead. So generous has Social Security for younger Americans become, in fact, that it amounts to Free Money.

The biggest problem in connection with Social Security—as the government itself is first to admit—is giving the money away. That is, the public's woeful ignorance of the availability of funds has prevented its full distribution. *Over one billion dollars*, according to experts, remains undistributed in U.S. Treasury vaults simply because no one steps forward to claim it.

To help overcome this shocking public ignorance, and see that you get your share of the Social Security largesse, the editors of **Moneysworth**, the authoritative new consumer-affairs and personal-finance fortnightly, have prepared—as a public service—a comprehensive, lucid, savvy, astonishing new manual entitled *STAKE YOUR CLAIM! How to Work the Social Security Gold Mine*. A copy is yours *ABSOLUTELY FREE* with a subscription to **Moneysworth**.

STAKE YOUR CLAIM! How to Work the Social Security Gold Mine is more than just an encyclopedic reference work with charts, tables, descriptions of benefits and sample application forms. It is a personal adviser in a field of finance where impartial advice is otherwise almost impossible to obtain (the government, of course, is biased and lawyers are almost never willing to accept Social Security cases because, by law, they are not permitted to charge more than about $10 per case). Among the priceless nuggets of information you will pick up from *STAKE YOUR CLAIM!* are answers to such questions as:

- How can you qualify for a pension even though you have never worked a day in your life, or contributed a cent in Social Security taxes, or even nearly reached the age of 65?
- How can you arrange to collect Social Security from *both* Canada and the U.S.?
- Why is it crucial to check the balance of your Social Security account periodically?
- Does it ever pay to take out *two* Social Security cards?
- Is it true, as some say, that you should "shop" at different Social Security offices since different interpretations of regulations can result in pensions of different amounts?
- What steps, if any, are necessary to protect your pension from attachment by creditors?
- Since, as studies have shown, two out of three workers *over*pay their Social Security taxes, how can you check on your payments and possibly obtain a refund?
- What forms of deception have people employed in order to maximize their Social Security benefits and collect pensions early?
- What federal program helps retired persons get jobs to supplement Social Security?
- What happens to your pension if an employer deducts Social Security taxes but fails to forward them to Washington for credit to your account? What special steps should you take if the firm you work for is financially shaky?
- How do you go about getting one of Social Security's huge "lump sum" payments?

In short, *STAKE YOUR CLAIM! How to Work the Social Security Gold Mine* is a treasure map to the Social Security mother lode, telling what pitfalls to avoid, what tools to use, how to find your way through the maze of regulations and how to hit pay dirt. Its editor and compiler is Ralph Ginzburg, the 43-year-old publisher of **Moneysworth**, who himself collects $99.40 in Social Security every month and has been getting Social Security since he was 25. To repeat, a copy of *STAKE YOUR CLAIM! How to Work the Social Security Gold Mine* is yours *ABSOLUTELY FREE* with a subscription to **Moneysworth**.

In case you're not familiar with **Moneysworth**, let us explain that it is America's most ingenious periodical dealing with personal finance and consumer affairs. It will positively flabbergast you with its inventiveness for making and saving money. In less than three years it has bestowed the Midas touch upon *nearly a million* ecstatic subscribers and has become the most widely read newsletter *IN THE WORLD*. Perhaps the best way to describe **Moneysworth** is to list the kinds of articles it prints:

How to Earn 10½% on Your Savings Account
Digital Wristwatches: A Product Rating
Buying a New Car for $125 over *Dealer's* Cost
Shrewd Buys in Life Insurance
Air Travel at 50% Off
Minicalculators under $100
Professional Sex Counseling, $00 Per Hour
Belted Tires: A Rating without Bias
How to Buy a Pistol for Protection
Dog Foods Fit for King
How to Contest a Bad Credit Rating
Quadraphonic Hi-Fi: Innovation or Hype?
Wheeling and Dealing for a New Bike
Free Stock Advisory Services
Easy-Riding Motorcycles
Pianos of Note
Trailers with No Hitches
Home Burglar-Alarm Systems
Cheap Skates
Stoves that Are a Turn-On
The ABC's of Buying Vitamins
Scholarships that Go Begging
Sailboats that Are Winners
How to Break a Lease
Legal Ways to Beat Sales Taxes
How to Protect Your Heirs
Earn Interest on Your *Checking* Account
How to Fight a Traffic Ticket
14 Ways to Save on Your Phone Bill

In sum, **Moneysworth** is a shrewd, trustworthy financial mentor. It is the quintessence of sophisticated gainsmanship.

The staff of **Moneysworth** is a team of hard-nosed, experienced journalists with a record of genius in the field of consumer affairs. Its publisher, as we mentioned earlier, is Ralph Ginzburg, creator of the daring and flamboyant magazines *Fact*, *Eros* and *Avant-Garde* (Mr. Ginzburg was first to publish Ralph Nader). **Moneysworth**'s editor-in-chief is Albert Lee, a former top editor of *Better Homes & Gardens*. Radiating from this nucleus of editorial energy are reporters and product-testers throughout the U.S.A. Together they create America's first—and only—consumer periodical with *charisma*.

Moneysworth is available by subscription only. The cost of a year is *ONLY $5!* This is a *MERE FRACTION* of the price of familiar, old-fashioned consumer publications. Moreover, we are so confident of **Moneysworth**'s value to you that we are about to make what is probably the most generous money-back guarantee in publishing history: *We will absolutely and unconditionally guarantee that* **Moneysworth**—*in combination with STAKE YOUR CLAIM! How to Work the Social Security Gold Mine—will increase the purchasing power of your income by at least 15% or you get your money back IN FULL.* In other words, if you now earn $10,000 a year, we guarantee that **Moneysworth** and the Social Security manual will increase the value of your income *by at least $1,500*—or we'll refund your money. Meanwhile, you will have enjoyed a year of **Moneysworth** *ABSOLUTELY FREE* and you may keep *STAKE YOUR CLAIM!* WITH OUR COMPLIMENTS!! What could be more foolproof?

To enter your subscription, and obtain a free copy of *STAKE YOUR CLAIM!*, simply fill out the coupon below and mail it with $5 to: **Moneysworth**, 110 W. 40 St., New York 10018.

Then sit back and prepare to receive your first copy of a gleeful, irreverent, wallet-fattening periodical whose motto is: "Ask not what you can do for your country, but what your country can do for you."

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Saturday Review of
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FEBRUARY 24, 1973 VOLUME 1, NUMBER 1

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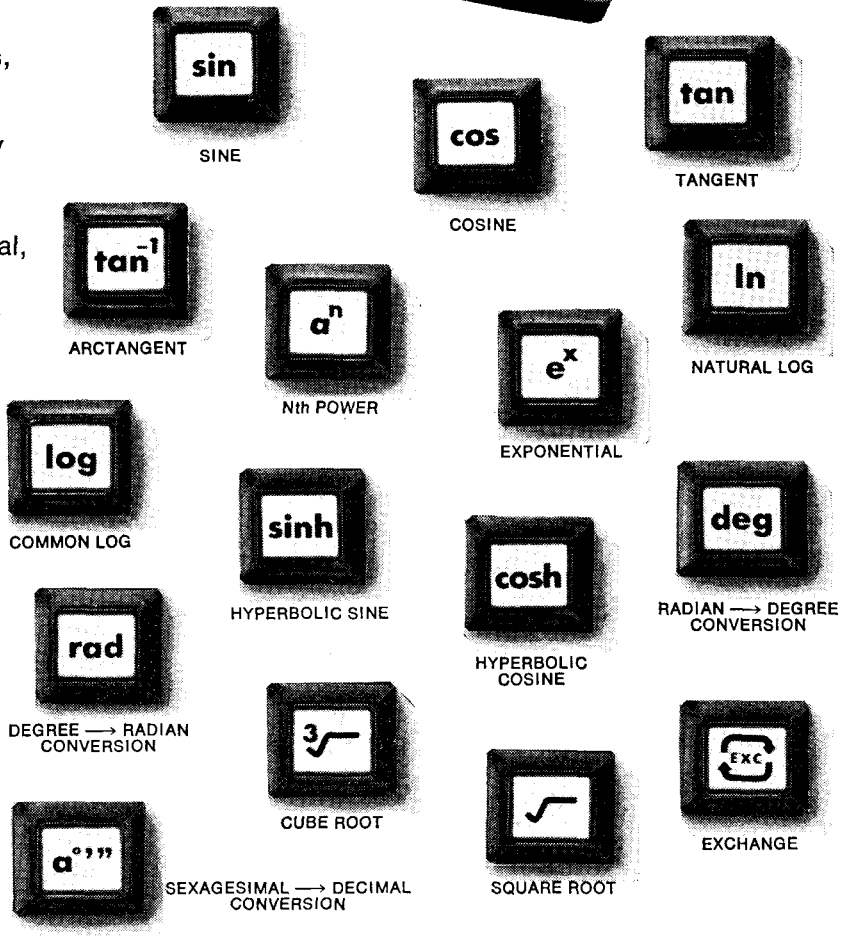

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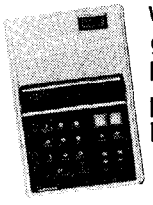

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INSIDE SR

Is old age a curable disease? Can death be postponed? In our cover story **Albert Rosenfeld**, the former science editor of *Life* magazine, explores these fascinating questions. In recent years Rosenfeld has increasingly concentrated his attention on the revolutionary developments in biology and medicine, particularly their ethical implications. For more than a year he has been adjunct professor of biophilosophy—the first position of its kind—at Drexel University in Philadelphia and has received numerous requests to teach, lecture, and set up programs concerning the impact of biological advance on society. Winner of several awards for science journalism, Rosenfeld was introduced to gerontology (the study of aging) while working on his book *The Second Genesis: The Coming Control of Life*. He is now writing a book specifically on aging research.

Rosenfeld

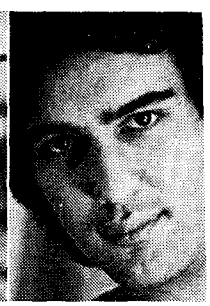
Stuckey

There is very little that **William K. Stuckey** does not know about the Nobel Prize. As a freelance writer, he has written a number of articles, as well as a television documentary for England's BBC, dealing with the power and politics of the Nobel Prize-awarding establishment in Stockholm. To date, he has interviewed a dozen Nobel judges and numerous prize winners in Europe and the United States. In this issue of *The Sciences* Stuckey takes a close look at physicist John Bardeen, the first person in history to win two Nobel Prizes in the same field.

As **Richard J. Vogl** well knows, wrestling with Smokey the Bear can be quite a strain. Like most ecologists who have tried to demonstrate the beneficial effects of burning, Vogl has consistently encountered resistance from fire-fighting factions that have devoted decades to convincing the nation that all forest fires must be prevented. Vogl became involved in the fire controversy while earning his Ph.D. at the Plant Ecology Laboratory of the University of Wisconsin. There he worked with Dr. John T. Curtis, a leading proponent of a more reasoned approach fires, and helped him determine wh project in controlled burning was p ducing spectacular vegetational grow Vogl has been an outdoor enthusi since his boyhood days on his gra father's farm and has traveled ext sively, learning about fire in various vironments. As professor of biology California State University, Los geles, Vogl's primary goal is to impar sensitivity for the natural world to students, his children, and his friend

Roger Rapoport, author of "Electro Alligators," first became intrigued wi industrial security while researching book on the nuclear weapons establis ment, *The Great American Bomb M chine*. He learned, for example, th some government security agents spo with employees' former kindergart teachers before issuing top-secret clea

Vogl



Rapoport

ances. While researching this article fc *The Sciences*, Rapoport himself unde went the severe scrutiny of modern s curity systems: he was shadowed to th bathroom, denied entrance to "classi fied" areas, and furtively requested no to reveal the secrets of high-securit computer centers he had uncovered Rapoport is a freelance writer based i El Cerrito, California.

Scattered newspaper clippings an tight-lipped government scientists le **Bruce Wallace** to write "Conscriptio at Sea," an essay on the navy's highl questionable attempt to use marin animals in warfare. Wallace, professo of genetics at Cornell University, is th author of a three-volume work *Essays in Social Biology*.

Most of the reviews in this issue of *The Sciences* were written by the staff. However, in Social Sciences, **David Perlman**, science editor for the *San Francisco Chronicle*, reports on an experiment that questions the definition of mental illness, and freelance writer **Barbara Heine** discusses a convention of underwater archaeologists. F.K.

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Tracking the Flu

BY PATRICK YOUNG

By tradition, the "London flu" should be called "Indian flu," for India is the country where it first struck in 1971. Instead, it is named for the city where, in January 1972, it was first recognized as a new variation of an old disease.

At first the World Health Organization's World Influenza Center, which identified this viral cousin of the Hong Kong flu, wasn't certain that it would cause epidemics. Other Hong Kong variants had been isolated, and none had spread widely. However, by late spring the London flu was a household companion, if not a household word, in Malaysia, Singapore, and Korea. This fall it hit the United States, beaching first in Hawaii and then popping up in Colorado to strike nearly a quarter of the Air Force Academy's cadets. It finally reached epidemic proportions this January with outbreaks in more than half the states.

For flu victims it meant the usual fever, chills, sore throat, headaches, and aching muscles. For virologists it was further frustrating proof of influenza's unique disease status: the bug keeps changing its chemical makeup and confusing the body's immunity system.

Minor variations occur from year to year, making old flu vaccines only 75 or 80 per cent effective at best. Every ten years or so the change is so great that, in effect, a totally new influenza virus appears. Vaccines and the natural immunity humans have built up from previous flu exposure become almost useless. The result is a worldwide epidemic like the Asian flu in the late 1950s and the Hong Kong flu a decade later.

"This is an extraordinarily complicated disease," says Dr. Edwin D. Kilbourne, chairman of the microbiology department of Mount Sinai School of Medicine in New York City. "There is no other infectious disease that changes to this degree. No other vaccine is faced with a shifting target." Thus, a minor genetic change in the Hong Kong flu produced the London flu and epidemics in several countries this winter, including England, Russia, Iceland, Albania, and Bulgaria.

Of the three basic types of influenza —A, B, and C—only Type A viruses cause such widespread disease. Researchers are baffled by the way the Type A virus unpredictably changes its chemical arrangements. Its minor genetic alterations may result from mutations, but its major shifts are too great to be explained by mutational changes alone.

The fact that at least eleven animal-flu viruses exist leads to one fascinating possibility: new human-flu viruses may result from two animal-influenza viruses pooling their genetic traits within animal cells. "There is evidence that recombination can take place in laboratory animals," says Dr. Kilbourne. "But this has not been demonstrated in nature."

Dr. Julius Kasel and Dr. Robert Couch of Baylor College of Medicine in Houston have infected human volunteers with a horse-flu virus under controlled laboratory conditions. They also have infected ponies with the Hong Kong flu. However, so far no one has proved that animals can pass the flu on to man, or vice versa, outside the laboratory.

The next influenza pandemic is expected late in this decade. Although no one can predict exactly when or where it will start, or how severe it will be, it is not expected to match the 1917–18 pandemic that killed an estimated 21 million persons, including 500,000 in the United States.

"The only thing we can really predict is that influenza will continue," says Dr. Kilbourne. □

Patrick Young is a science writer for The National Observer.

Edible Newspapers

BY ROGER FIELD

Thinking of eating some newspaper? Don't laugh; newspaper is mostly cellulose, and for years scientists have been experimenting with ways of converting old newspaper to food for either humans or animals. The latest advice, though, is to stay away from the comics section. According to scientists at Cornell University, the comics are, literally, less digestible than straight news, printed in black ink. It seems the funnies

are printed with colored inks that contain potentially harmful heavy metals.

The problem has always been the ink. Scientists at the U.S. Army's Natick Laboratories, for example, succeeded in making a kind of pancake syrup by converting the cellulose in old newspaper into sugar, but a complicated filtration process was required to remove all traces of ink from the syrup. According to the Cornell scientists, even black ink can be harmful. Black newspaper ink contains varying amounts of PCBs (polychlorinated biphenyls), chemicals so toxic that plans to feed even the news section to farm animals have been temporarily abandoned.

However, the Cornell scientists did discover that some daily papers have relatively low levels of PCBs. This suggests that papers could be printed from scratch to be less toxic and more edible if inks were reformulated and paper processing adjusted. Thus, we may someday dine on *Wall Street Journal*-burgers, *Washington Post* gumbo, and *Daily News* pie. Bon appétit. □

Roger Field is the science specialist for WINS *radio in New York.*

ILLUSTRATIONS BY JERRY MacDONALD

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Land Life: A Speculation

BY ISAAC ASIMOV

As far as paleontologists can tell by careful study of carbon traces in very ancient rocks, life may have begun on Earth as long as three billion years ago. It seems to have begun in the sea; it was a mere 400 million years ago that the dry land began to be colonized by life forms.

Presumably, the colonization of land took place by way of the tides. In the twice-daily wash of water up the shore and back, living organisms of various kinds were left behind and gradually underwent adaptations enabling them to survive the temporary absence of water. Through natural selection some were able to live on dry land permanently. But why did it take so long? Why did life remain at sea for more than two and a half billion years, with dry land untenanted, and *then* spread out over the land surfaces?

Here is another, apparently unrelated puzzle. Why does Earth have a large moon? Small planets—Pluto, Venus, and Mercury, for example—have no satellites at all. All the other planets have satellites that are one-thousandth their own size or less. Mars has two satellites, each only a dozen miles across. The Earth, however, has the moon, which is one-eightieth its own size and rivals the largest satellites of the giant planets.

What's more, the moon doesn't revolve in the plane of Earth's equator, as one would expect a satellite to do, but revolves more or less in the plane of the sun's equator, as a planet would do. Then, too, the moon rocks brought back by astronauts show us that the moon's crust is far more heat-baked than one would suspect at its present distance from the sun. Might it be that the moon was once an independent planet that passed fairly close to the sun at one end of its orbit? That would heat-bake it. At the other end it might have come fairly close to Earth's orbit and eventually could have been captured by Earth. There are even reasons for suggesting that the capture took place as recently as 600 million years ago.

Thus, many million years may have passed before the moon settled down in its present nearly circular, gradually retreating orbit. During that period of time the tides on Earth, thanks to a generally close moon, would have been extremely active. It may have been in this wild interval that sea life was dashed onto the shore with enough vigor—and exposed to water absence with enough pertinacity—to supply sufficient pressure for the development of land life.

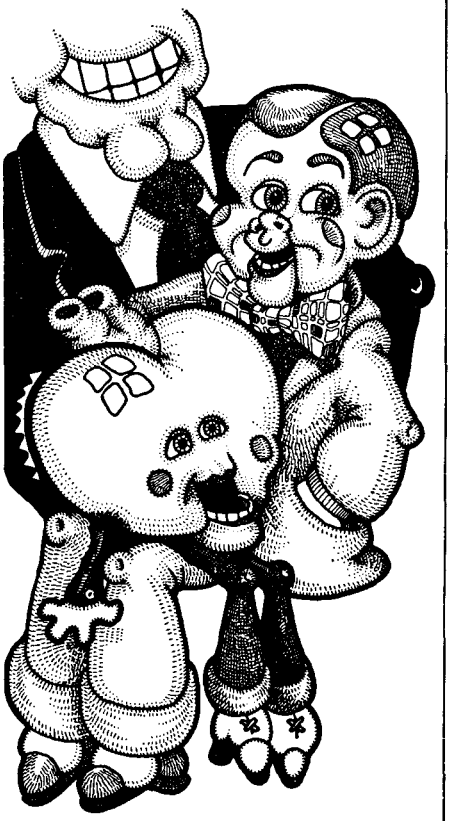
It appears that the capture of a large satellite like the moon is a rare and unlikely event. But what if it is only through the capture of such a satellite, and a long following period of giant tides, that land life can develop? Then man might find himself in an odd position.

Astronomers suspect there may be uncounted millions of Earth-like planets in the universe that bear life. But of them all, how many would bear *land* life? Might it be that in a universe swarming with life, it is only the fish who have company and that we ourselves are alone after all? □

Isaac Asimov, a frequent contributor to SR of The Sciences, *is the author of more than 130 books.*

Pinocchio Updated

On July 16, 1963, ventriloquist Paul Winchell was awarded U.S. Patent Number 3,097,366 for his invention of an artificial heart. Before that date his best-known creation was the puppet



Jerry Mahoney; even afterward it seemed that the wooden doll's position was in no danger of being eclipsed, for the American Medical Association and the American Heart Association both spurned Winchell's artificial heart.

The patent lay filed away, forgotten, and probably would have remained so had not another inventor happened upon it. This particular inventor, Dr. Willem Kolff, is undoubtedly less well-known than Mr. Winchell outside the medical community. Yet his string of inventions includes the first practical artificial kidney, the first artificial lung used in human surgery, and the first heart assistance pump. Dr. Kolff, head of the artificial organs division at the University of Utah College of Medicine, who had been working on an artificial heart since 1957, realized that all of his research was leading closer and closer to Winchell's original design. Indeed, he was infringing on the Winchell patented heart.

Dr. Kolff's conviction that the ventriloquist had something was good enough for the university. Late last year he sent the following letter to all involved parties:

"This letter is to inform anyone concerned that the University of Utah and Mr. Paul Winchell have entered into an agreement dated January 26, 1972, for a joint effort in artificial heart research. It has been agreed that Mr. Winchell and Dr. W. J. Kolff of the University of Utah have independently developed artificial hearts based on the same principles as described in a patent applied for by Winchell in 1961.

"By the agreement mentioned, Winchell has assigned his patent to the University and the University will make available to him access to University laboratories and hospital facilities for joint efforts in further research. Also by this agreement, it is our belief that Mr. Winchell can make positive contributions to the artificial heart as demonstrated by his prior research and patent."

Winchell has had no formal science or medical training, but his invention should come as no surprise; after all, Geppetto was only a simple woodcarver. □

The Chauvinist Computer

The computer unfailingly gave correct answers to men, but whenever a woman approached it, the machine spewed wrong or absurd answers. According to Tass, the official Soviet press agency, male chauvinism was not the problem. It seems the machine, located at the Novosibirsk computing center in Siberia, was allergic to women's clothing. "Synthetic fibers," reported Tass, "produced an electric field which affected the computer's performance." □

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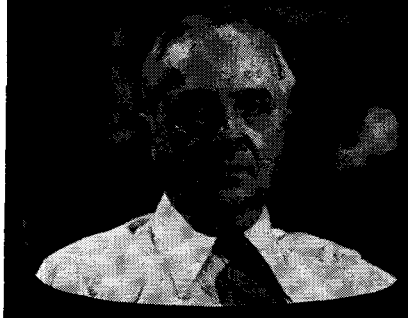
What color tv do these tv experts own?

"I know what the professional monitors look like—live with them in fact. The XL-100 presents a picture that compares very well with the best of them. . . . Reproduction of skin tones, of course, is the most critical test of any set. The XL-100 does a very good job in this area." *Jim Schmidt, chief engineer, WDAF-TV.*



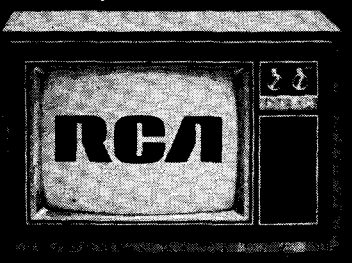
"I like the color tracking in the new RCA receiver. . . . When the blues will stay blue, and the reds will stay red between light and dark—well, you know your receiver will give you good performance." *Ed Risk, chief engineer, KSD-TV.*

"I have two RCA color television receivers in my home because of their color fidelity and their reliability." *Otis Freeman, chief engineer, N.Y.C.*

"When someone asks me which tv set they should buy, I always recommend RCA. No one's ever squawked." *Wayne Anderson, chief engineer, St. Louis.*

Color you can count on.

More than twice as many tv chief engineers own RCA as any other color tv.



XL-100 model GR-802

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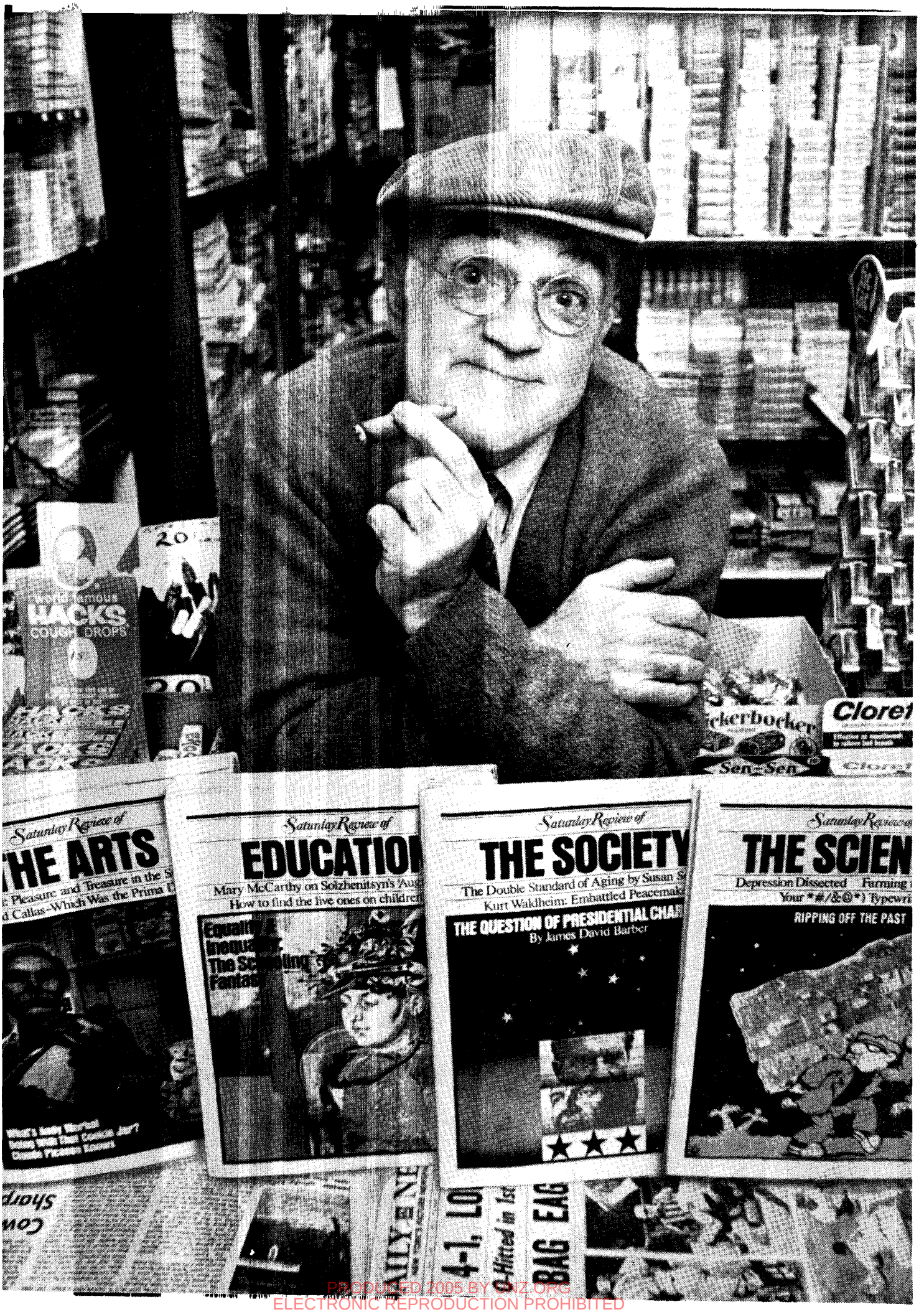

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Which would you rather read?

There are now four aturday Reviews.

Each looks at the world from a rent vantage point.

Which gives you an interesting ce. Read what each magazine is it, and then see if you can make a sion about which you'd rather ve every month.

THE ARTS

For too long, the arts have been phered in a palace language, which the initiated elite could understand enjoy.

Well, the editors of Saturday iew have created a monthly magazine ted solely to the arts, and to phering the palace language.

SATURDAY REVIEW OF E ARTS features eight regular rtments: Music, Cinema, Art, ater and Dance, Architecture and gn, Writing, Entertainments, People and Ideas.

It will keep you current, and lved. Some samples of articles:

¶The Perfect Rock Concert.
¶Vietnam War Art.
¶The Great American Movie Game.
¶Claude Picasso on the private ctions of America's best-known ern artists.
¶A look at mainland Chinese crafts.
¶Street mime in San Francisco.
¶The International Arrival of erimental sound.

You'll really enjoy SATURDAY VIEW OF THE ARTS.

EDUCATION

In today's Knowledge Society, problem is not getting new infor- ion: it is developing new ways to n, and to apply new knowledge.

SATURDAY REVIEW OF UCATION is designed to help this cess.

There is more to educational nge than turning blackboards green.

Here are some of the things you will read about in SATURDAY REVIEW OF EDUCATION.

¶VD on TV.
¶Experimental Colleges.
¶Slow Learners.
¶Equality vs. Inequality.
¶Should schooling be compulsory? Direct reports from states where it is not.
¶Changes in mass "higher education."
¶Economic and social systems in the public school microsociety.
¶Are "educational" toys really educational?
¶Do "crash courses" for College Boards really help?
¶Education beyond college.

THE SOCIETY

The individual in today's society might as well be in a pinball machine.

Virtually everything that happens in society affects his life, yet for the most part, he is almost powerless to cope with it. The future shock phenomenon just accelerates the change, and makes its impact harder to take.

Well, the editors of Saturday Review have a partial solution to the problem. It's called SATURDAY REVIEW OF THE SOCIETY, and in a way, it is a survival manual. Its job is to keep you ahead of the current turmoil in society: politics, leisure, youth, labor unions, welfare, old age, advertising, environment, technology, the economy, communications, jobs, war, freedom.

Some samples of what it covers:

¶The Doomsday Syndrome.
¶Predicting Presidential Character.
¶The American Obsession With Fun.
¶A Tax Reform Symposium.
¶The Double Standard of Aging.
¶A Product Safety Computer.
¶The Swing Justice of the Supreme Court.
¶Can Wall Street Afford a Social Conscience?
¶The Skyjacker and How to Stop Him.
¶How the Army is Destroying Itself.

SATURDAY REVIEW OF THE SOCIETY will help you to understand the changes in society before they take place, and give you a leg up on dealing with them.

SCIENCE

Though science can be compellingly relevant in our daily lives, most of us never quite learned enough of it to put it to work for us.

Even the scientist is a layman outside of his field of specialization.

Yet up until now, there has been no magazine devoted to science that is fully comprehensible to the layman, enjoyable to read, and packed with useful knowledge.

SATURDAY REVIEW OF THE SCIENCES fills this void.

Here's a sampling of articles:

¶Death of the Elephants.
¶The Anatomy of Melancholy.
¶Isaac Asimov on the Ultimate Speed Limit.
¶The Life and Death of the American Chicken.
¶Senator John V. Tunney on Genetic Management.
¶Archeological Looting.
¶Zoos where people are caged while the animals run free.
¶The psychological implications of vasectomy.
¶The technology of TV violence.

SATURDAY REVIEW OF THE SCIENCES will be the publication you'll look forward to getting every month.

Any one of these magazines is now available at the half-price charter subscription rate.

If you're torn between two of them, you can get both.

THE SATURDAY REVIEW FAMILY OF MAGAZINES.

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WIT TWISTER NO. 320

Edited by ARTHUR SWAN

The object of the game is to complete the poem by thinking of one word whose letters, when rearranged, will yield the appropriate word for each series of blanks. Each dash within a blank corresponds to a letter of the word.

A — — — — — — brings his
flock of gravid ewes

To graze and — — — — — —
in the ruined nave.

Awhile this — — — — — —
stops to rest and muse

Upon the — — — — — —
marker of a grave.

Here — — — — — — with accused and foe with friend

Are reconciled at last, all strife at end.

A.S.

Answer on page 70

FRASER YOUNG LITERARY CRYPT NO. 1543

A cryptogram is writing in cipher. Every letter is part of a code that remains constant throughout the puzzle. Answer No. 1543 will be found on page 70.

QFL LFOARNDTB FSRNC

LFTBA ZR ED MQRNR LRNR

OF GEOXRNG.

NFGGEOE

Bottled Water

Water, water everywhere, but from which bottle should you drink? There is bottled spring water, containing lots of minerals and sometimes a generous helping of bacteria, and purified water, purged of harmful chemicals and bacteria but also of the minerals that nature may have intended us to drink. Bottled-water buyers remain confused, insisting not only that the bad things be left out but that the good things be kept in.

The dilemma is heightened by the fact that, despite their labels, bottled waters differ greatly in content. For example, spring water is simply water that comes from the ground. It may have high mineral content; it may not. Also, it may be polluted. So-called purified water, on the other hand, is any water that has been treated to remove chemicals, whether it comes from a spring or a city's water supply. However, purification processes vary to such an extent that some so-called purified water still contains minerals and bacteria. In fact, the Food and Drug Administration recently announced that 8 per cent of all bottled water—spring and purified—sold in the United States contains too many bacteria to meet national health standards.

For the distraught consumer fearing for his health, there may be a simple solution—tap water. In mineral content it lies somewhere between the two bottled libations. It's cheaper, too, costing about 1/50 of a cent per gallon, whereas purified water costs 3 cents per gallon and spring water an astounding 60 cents per gallon. (Annual sales of bottled water average in excess of $100 million.) And so long as bottled waters vary so greatly in content, with the tap variety at least you know what you're getting. □

Gravity Suspended

The following memorandum, distributed to the students and staff of Cal Tech by person or persons unknown, recently appeared in Physics Today.

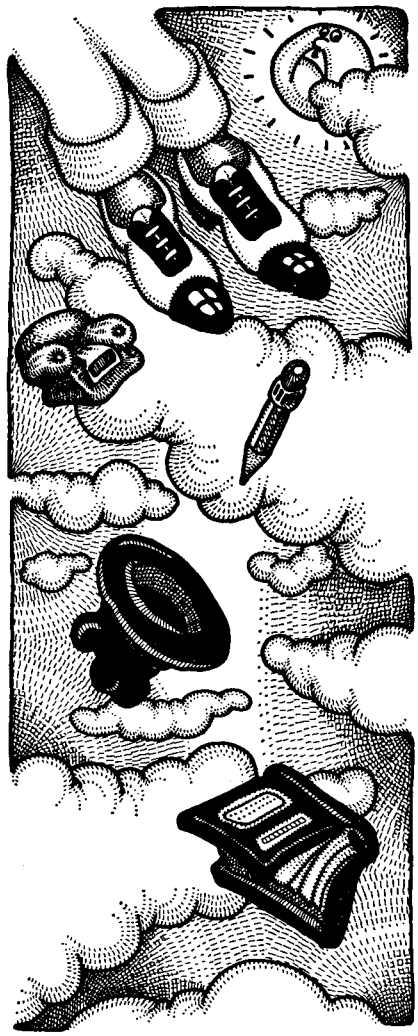
TO: Campus
FROM: Physical Plant
SUBJECT: Interruption of gravity

The campus architect has requested a temporary interruption of gravity for the purpose of making certain major alterations of campus design. Gravity will be off for approximately 11 hours next Tuesday, from 7 a.m. to 6 p.m. Only the campus area south of San Pasqual Street will be affected.

We have been advised that the interruption will undoubtedly create noncausal gravitational singularities along the boundaries of the region affected. Therefore San Pasqual will be closed to traffic throughout the day.

The following precautions are advised:

- All heavy equipment should be tied down.
- Personnel are urged not to leave buildings. If forced to travel from one building to another, use the steam tunnels.
- Since elevators will be inoperative during this time, please use stairways.
- All people normally parking cars south of San Pasqual should take care not to do so.
- Please do not flush toilets. □



End of Phase One

The eruption of environmental consciousness began roughly four years ago, touched off in part by the belated discovery that DDT was finding its way into every ecological niche and cranny. The pesticide fight really began in

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1969, when a fiery lawyer named Victor Yannacone, Jr. (whose motto later became "Sue the Bastards!") took on the Suffolk County Mosquito Commission on behalf of the Environmental Defense Fund. Yannacone lost the case but won the point: DDT is bad for marshes. So closely was the DDT battle linked with the identity of the environmental movement that when the chemical was at last banned on January 1, 1973, it could be said that "phase one" of the movement—wherein most of the environmental culprits were identified and attacked—had drawn to a close.

The final ban drew surprisingly little attention, considering the 675,000 tons of DDT utilized in this country over three decades and the heat of the court battles that raged over the last three years. The contest, at the beginning, seemed ludicrous: a handful of lawyers and biologists versus some of the nation's mighty chemical corporations and the U.S. government itself. Moreover, the issue was far from black and white, for DDT was still remembered by many with gratitude for the anti-typhus role it played during World War II and its effectiveness in combating malaria. The agricultural establishment predicted the ban would result in widespread starvation.

The dispute gave rise to a legal assumption that seemed rash indeed at the time: that a single man—without pull, even without funds—could challenge an entire corporation or government on behalf of his vaguely defined right to a clean, quiet, healthy environment. This assumption has led to an entirely new interpretation of legal "standing" and has literally made environmental law possible.

It also gave rise to a new uncertainty. As fast as the environmentalists summoned biologist-witnesses to the stand —persons now famous in the annals of environmental litigation, such as Charles Wurster, Joseph Hickey, Robert Risebrough—the chemical companies came up with their own experts to dispute every "scientific" assertion. Both sides could not be right, of course, and it became apparent even to laymen that scientific results, like most other aspects of human endeavor, can be bent to support personal prejudices. As Mark Twain supposedly said, "First gather your facts, then distort them." □

Oskar's Exotic Hands

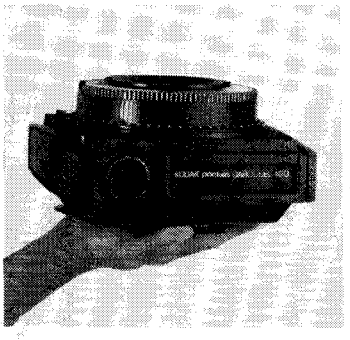
BY GAIL BERNICE SULLIVAN

Your initial reaction to what I am about to recount will undoubtedly be disbelief. Almost everyone to whom I've told this story finds it incredible; nevertheless, it is true.

The pick of the Pockets.

It's the Kodak pocket Instamatic 60 camera—a brilliant performer under a wide range of lighting conditions.

It has a superb 4-element *f*/2.7 Ektar lens. Sophisticated electronic exposure control. Coupled rangefinder. And more.



You get sharp color snapshots (3½ x 4½ inches) or Pocket slides about one-inch square. (To show 110-type slides at their best, there are Kodak pocket Carousel projectors that are only a little over 8-inches square.)

Pick a Pocket 60 at your photo dealer's. Less than $138.

Price subject to change without notice.

Kodak pocket Instamatic® 60 camera. Kodak

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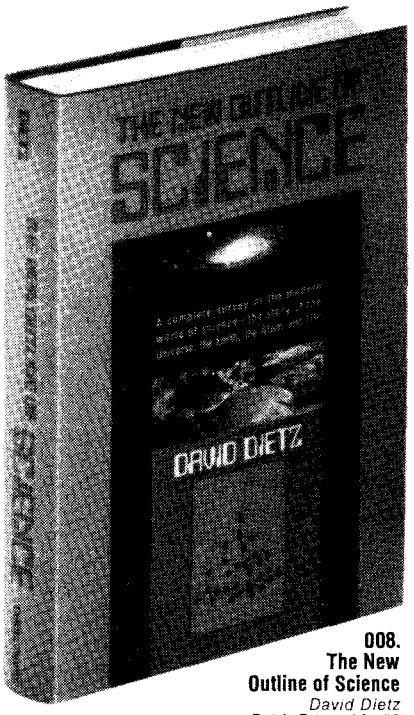
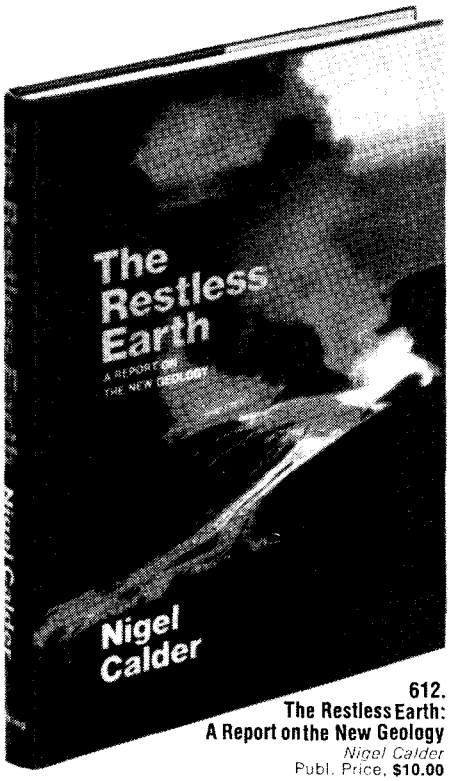


008. The New Outline of Science
David Dietz
Publ. Price, **$17.50**



612. The Restless Earth: A Report on the New Geology
Nigel Calder
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51 Biofeedbac Turning On tl Power of Your Mi
Marvin Karlins
Lewis M. Andrev
Publ. Price, **$5.**

a new approach to the curse of being bright

030. Albert Einstein: Creator and Rebel
Banesh Hoffman
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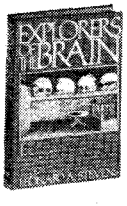

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573. Birds, Beasts & Men
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378. The People's Handbook of Medical Care
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429. The Story of Anna O
Lucy Freeman
Publ. Price, **$7.50**

387. The Politics of the Family and Knots
R. D. Laing (two books count as one)
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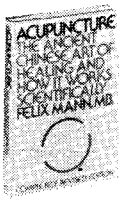

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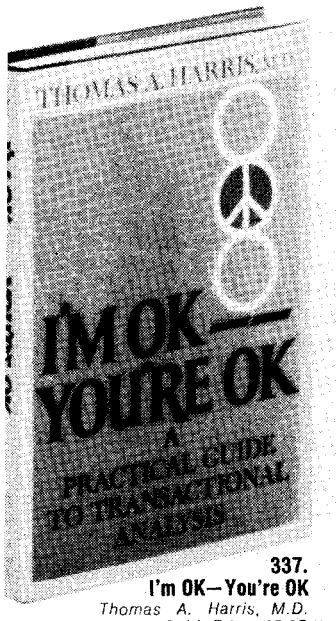

337.
I'm OK—You're OK
Thomas A. Harris, M.D.
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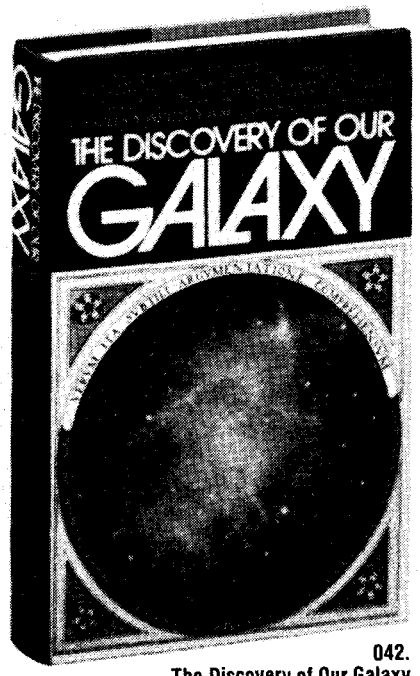
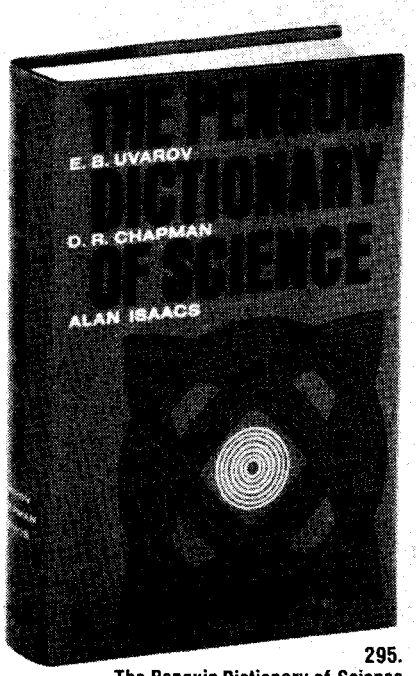


042.
The Discovery of Our Galaxy
Charles A. Whitney
Publ. Price, **$10.00**



295.
The Penguin Dictionary of Science
E. B. Uvarov, D. R. Chapman & Alan Isaacs
Publ. Price, **$11.95**

The new Saturday Review Science Book Club offers their sympathies with your choice of...

ANY 4 FOR $1.

If the signs point to your being one of those one-half of one percent of the people in this fair land who are so cursed with intelligence and curiosity that they regularly read *non*-best sellers. You have our sympathies . . . and so an offer to join some of the rest of us unfortunates in doing something about our common problem.

A case in point is the very name, "science". You may be the product of endless hours wasted on frog legs, pig corpses, rocks and tiny wriglies so that you would know about science and be "rounded". Actually, in its original meaning "scientist" refers to *someone with an itch to know about things*. You may have the problem of being curious about a great many things—most of them specialized or obscure or difficult enough so that the books which deal with them are generally not best sellers. And because if there is a new book out on a subject you're interested in, you must have it—and hang the price.

That's all very well until the end of the year when you see what you've paid and then feel like hanging yourself!

Consider an alternative

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As far as I know, the beginning goes back only a decade or so to a small laboratory at McGill University in Montreal, where Dr. Bernard Grad completed a series of experiments, the results of which were, to say the least, unsettling. Dr. Grad, you see, did careful, scientific studies on the supernatural. Not his conventional research, mind you, which focused on problems of aging; this exploration was a spare-time venture into the realm of parapsychology known as healing by the laying-on-of-hands.

The subject of Grad's experiments was one Oskar Estebany, a retired Hungarian army colonel. Although in layman's parlance this staunch gentleman could be called a healer, he never advertised or exploited his unique gift. In the first experiment Estebany was to prevent growths from forming in laboratory mice that were treated with a chemical that ordinarily distends the thyroid gland to ten times normal size. The mice with which Estebany had no contact formed huge thyroid tumors, but, remarkably, those that he held daily remained active, and tumor formation was dramatically retarded.

Estebany went on in Grad's laboratory to heal mouse skin wounds and, in one extraordinary experiment, to induce barley seeds to germinate and grow to seedlings when watered by a salt solution that ordinarily would have stunted their growth.

The scientific community's reaction to these singular results was total silence. Said Grad: "I think they are afraid. I have a feeling it is not anything else. They just don't want to look at this thing."

I did not hear of Estebany again until last fall at a symposium on unorthodox healing at Stanford University. There I happened to meet Sister M. Justa Smith, a Franciscan nun with advanced degrees in mathematics, physical chemistry, and biochemistry. Officially, she is chairman of the National Sciences Concentration at Rosary Hill College in Buffalo and director of research for the Human Dimensions Institute. Skeptical of Grad's results, she invited Estebany to spend four weeks at the college so that she could test his remarkable ability. Her experimental premise was based on cellular chemistry: all metabolic reactions within cells are catalyzed by specific enzymes, and most, if not all, illnesses, she believes, involve enzyme malfunctions in one way or another. If Estebany actually can heal, she reasoned, then he had to be able to affect enzyme levels in the body.

She decided to compare the activity of the digestive enzyme trypsin in isolation and in contact with Oskar's hands. Time after time, measurements showed that the activity rate of the enzyme in the flask touched by Estebany was significantly greater than the control. There was never a time when a negative result occurred. In her report of these experiments, Sister Smith commented that Estebany influenced the activity of the enzyme in promoting a more rapid digestion of protein. This may mean, she speculated, that amino acids formed as a result of protein degradation could contribute to overall good health by providing the blood with necessary building blocks for growth and repair of tissues.

A little over a year ago Sister Smith repeated the Estebany tests with three other people, all claiming to be healers. Although the results obtained during each day's experiments were erratic, all three healers were consistently able to increase the enzyme activity. Control tests, conducted at the same time, showed that three nonhealers had absolutely no influence on the enzyme activity.

Although there is no known way of directly measuring psychic prowess, the Smith enzyme technique is the closest science has come yet to recording this type of energy. Sister Smith believes that her enzyme test can be used not only for detecting authentic healers but for exposing charlatans, since they would have no influence over the activity rate.

How can it be that a force generated by some individuals is capable of reversing disease or increasing metabolic activity? "We know," says Sister Smith, "that the body is able to heal itself in many cases. No matter the number of degrees held by a physician, he must depend upon the innate intelligence of the patient's body to effect the actual repair process." Perhaps, she says, the psychic healer assists somehow in providing the right internal climate for healing—facilitating the cell's ability to adapt to its micro-environment. □

Gail Bernice Sullivan is a freelance writer based in California.

Bionarcs

The New York City Criminal Justice Coordinating Council is now conducting a three-month field trial of a new type of narcotics agent. The crime fighter under study is a strain of marine bacteria, developed by the RPC Corporation in El Segundo, California, that is bioluminescent; like a glowworm, it emits light naturally. This particular strain of bacteria responds to the presence of heroin, lighting up whenever it is in the vicinity of the illegal drug. □

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TRAVEL

Where the Whales Are

BY GARRETT DE BELL

Near a deserted stretch of the rugged Baja California coastline in Mexico, sixteen-foot whale calves are nursed by their mothers, each one receiving more than 100 pounds of milk each day. The calves and cows are among the thousands of gray whales that come at this season to Scammon's Lagoon, a terminal point of the whales' annual 4,000-mile migration from their summer home in the arctic waters of the Bering Sea.

The birth and nursing of young whales is only one of the events that take place in the shallow, shifting waters of the desert lagoon. Rites of courtship and mating between these huge mammals also occur at the completion of their southward voyage. Since the period of gestation for the whales is one year, about half the females bear young at the lagoon; courtship and mating occupy the others, which have recently weaned yearlings.

Today the gray whales sport in their breeding grounds unthreatened by the commercial whaling ships that once decimated their population. In contrast to the fleets of whalers in years past, only a few boats now intrude upon the whales' 250-square-mile coastal lagoon. They are filled with people eager to get a close view of these immense marine animals.

The lagoon, discovered in 1846 by whaling captain Charles Scammon, is one of the few places in the world where large numbers of whales can be observed courting and caring for their young in their natural habitat. Such observation is possible because the gray whale has made a dramatic comeback from the onslaught of over-zealous hunters in the nineteenth century and again in the 1920s. In 1947 the gray whale became protected by the International Convention for the Regulation of Whaling. Since then only a few hundred have been killed by man (primarily for scientific reasons), and the gray whales have built their population back to a healthy total of between 6,000 and 11,000 animals.

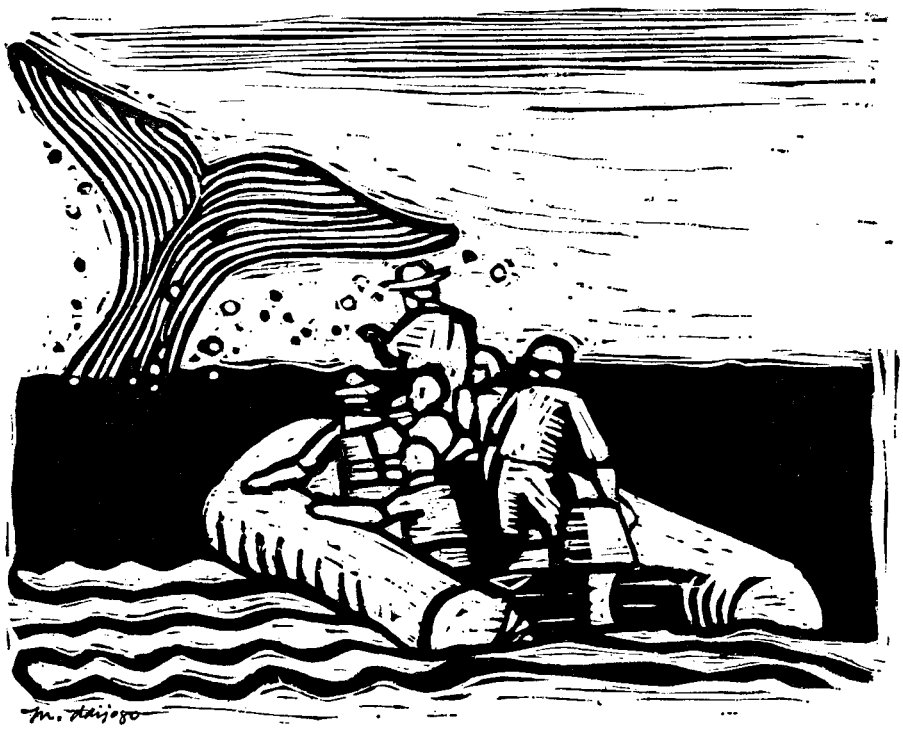
The gray whale is a forty-foot-long, twenty-five-ton creature, covered with barnacles and other parasitic marine life. Like its larger relatives, the blue whale and the humpback, it feeds by filtering organisms from the water with the plates of baleen (or whalebone) that hang down from its upper jaw like teeth. Unlike its relatives, the gray whale feeds mostly on the seabed. It scoops up large numbers of crustaceans and other bottom dwellers in its mouth and then pushes its tongue against the roof of its mouth, forcing the water back out through the baleen plates. Food trapped on the inside of the baleen is then swallowed.

The cold, highly oxygenated water of the Bering Sea and parts of the Arctic Ocean, where the gray whale summers, produces the masses of food necessary to support large populations of these huge animals. Scientists disagree about the details, but it seems safe to say that most of the feeding occurs at the northern end of the migration and little or no feeding during the migration itself or in the breeding areas. The whales live largely on the food reserves (blubber) acquired during the period of intense feeding.

In the fall the whales begin the southern migration, following the coastline and cruising at about four or five knots. They pass California from late December to February, providing thousands of people with an opportunity to observe them from headlands like Point Reyes (north of San Francisco), Point Loma (near San Diego), and Yankee Point in Monterey County. By March, after mating and calving in such places as Scammon's Lagoon, the grays head northward again for summer feeding.

Excursions to watch the whales in Scammon's Lagoon have been underway only since 1970, when the San Diego Museum of Natural History organized a highly successful trip to the lagoon. Each year the number of trips has increased, from eight in 1971 to about twenty-five planned this year. I have been on two of these and can testify that the experience is unforgettable.

Approaching the lagoon in an eighty-foot boat is like being in commuter traffic on the Golden Gate Bridge. For miles around, myriad spouts signal the presence of whales. Often the glistening



back or fan-shaped flukes flash into view as a whale dives.

Within the lagoon itself whales are everywhere. My most inspiring experience came as I sat quietly in a raft listening to the gentle whooshing of the whales, blowing quietly in the stillness

Garrett De Bell currently teaches a course about whales at the University of California, Berkeley.

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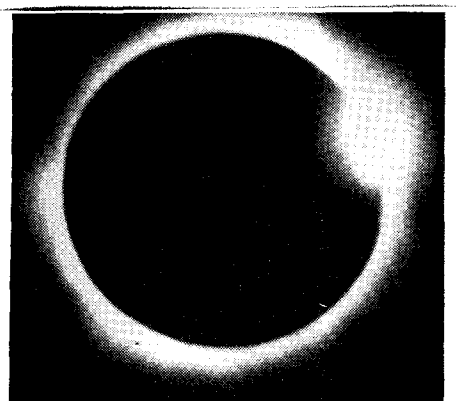

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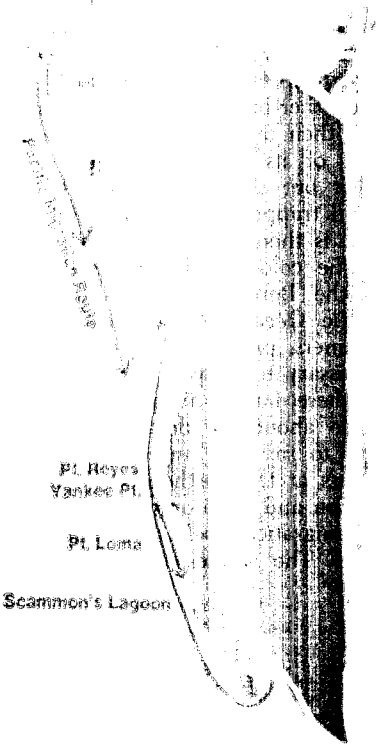

Each year the gray whale undertakes an 8,000-mile round trip from the Bering Sea to Baja California. Whale watchers can view the grays in their southern migration along the coast—particularly from Point Reyes (near San Francisco), Yankee Point (Monterey County), and Point Loma (near San Diego) from late December to February.

of the desert lagoon. The water lightened beside my raft, and a calf rose to blow a mere arm's length from me, followed a moment later by the roar of its mother blowing nearby. The excitement of seeing these graceful creatures never abates, no matter how often they're observed. (Indeed, when a whale pokes its massive head above water, "spy-hopping" in whaling terminology, it seems that we pique their curiosity, too.)

Not much is known about the breeding behavior of whales. But on one occasion I was able to watch part of a mating sequence. As is typical for gray whales, two bulls and a cow were involved. Biologist Ted Walker, who has spent more than twenty years observing gray whales, thinks the extra male helps to stabilize the pair as they are mating. My general impression of the whole episode was one of chaotic activity. Two heads rose out of the water together, one behind the other—then sank back below the surface. Shortly thereafter the male and female were side by side in the water. A long, pink penis (about five feet) was suddenly extruded and then could be seen lying across the female's back. The extra bull remained nearby. At this point they became aware of us. Apparently objecting to our presence, two of them, presumably the males, turned and headed straight for us, submerging just in time to pass right under our small raft.

I know of no one who has seen the birth of a gray whale. The innermost section of Scammon's, appropriately named the "nursery," is generally off limits to boats. But newborns paired with their mothers can be seen frequently outside the bounds of the "nursery."

The increased interest in whale watching, however, is causing concern that the boat traffic in Scammon's might drive the whales from the lagoon. The whales have already reacted to harassment by power boats in Southern California—they now tend to travel farther from the coast and closer to the Channel Islands. Consequently, all experts agree that boats should be kept out of the area in the lagoon where calving and nursing take place. A bluff overlooking this area, which is accessible by road, could be used for observation from above without disturbing the whales.

Since 1970 more than 1,500 people have had the unique experience of seeing the gray whales in Scammon's Lagoon. Few will forget the awesome sight of an enormous gray whale breaching—breaking the water at thirty knots, twisting in mid-air, and coming down in the placid waters with a stupendous splash. And few will leave without a deep commitment to the preservation of these magnificent leviathans. □

Whale Watchers

Trips to Scammon's Lagoon range in price from $220 to $400. For schedules of future excursions, contact the San Diego Natural History Museum (P.O. Box 1390, San Diego, Calif. 92112) or H & M Landing (2803 Emerson St., San Diego, Calif. 92106).

To find out about whales and their conservation, write to these organizations: Project Jonah (P.O. Box 476, Bolinas, Calif. 94924); American Cetacean Society (4725 Lincoln Blvd., Marina del Rey, Calif. 90291); the Whale Fund of the New York Zoological Society (185th St. & Southern Blvd., Bronx, N.Y. 10460).

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LETTERS

A More Human Human

Bruce Wallace suggests in his article "Man's Humanity" [*SR of The Sciences,* February] that the genetic engineer could no doubt produce a more human human than the *Homo sapiens* type. He implies this proviso: his own recipe for genetic alterations, his very own "catalogue of human qualities" is to be the blueprint. Let's multiply this egomania by several billion in order to simulate, as it were, the experience of chaos in deciding just which catalogue—his, yours, or mine—is to be put to use in the creation of the world's first "humanoid."

Mrs. E. S. Paar
Wichita, Kan.

"Man's Humanity" is typical of the superficial approach so characteristic of those trying to define *humanness.* A special problem is Bruce Wallace's infatuation with the "Golden Rule"—a seductive and clever phrase that saves people the trouble of thinking. For those fortunate enough not to know what it is, it goes like this: "Do unto others as you would have them do unto you." You had better look out, however, if I hate myself. In a world full of masochists, the Golden Rule becomes the problem instead of the answer. I propose as the new motto of mankind: "May man have mercy on other men." It is more appropriate to our times, because we are centuries away from the Golden Rule.

Dr. Samuel A. Nigro
University Hospitals
of Cleveland
Cleveland, Ohio

Eden Versus Evolution

While I deplore the efforts of religious groups to insert their beliefs into science courses, I have even stronger feelings concerning the tendency of teachers to present science, especially biology, as a body of "facts" ["Eden and Evolution," *SR of The Sciences,* February]. The idea that the evolution of life should be given the status of a biological theory is strongly supported. In my mind there is no question of its validity, but this does not make theory a fact. The evidence supporting the theory should be presented and the contradictory evidence should also be brought to the attention of students so that they can make their own decisions. Any other approach makes a mockery of science and its fundamental philosophy.

Ted O'Tanyi, Ph.D.
Assistant Professor of Biology
Widener College
Chester, Pa.

The Tragedy of Genetic Disease

I feel compelled to comment on Tabitha Powledge's article "The New Ghetto Hustle" [*SR of The Sciences,* February]. It seems to me that black people should welcome the attention that is being given to this terrible disease, in the hope that they and future generations will not live under this cloud. I am white and a carrier of another genetic disease, muscular dystrophy, which I have passed on to my son. I would gladly have undergone any test at any age to have prevented such a tragedy. Unfortunately, very little attention was being given to genetic diseases twenty-three years ago, when I married and started my family. Let's be thankful, whatever our race or color, that at last many of us can be warned and have a choice in such matters. What difference if it is motivated politically or otherwise, as long as the job gets done?

Mrs. S. L. Simmons
Beechmont, Ky.

Working Centenarians

Barnard Collier's article "'Tis a Hundred Years" [*SR of The Sciences,* February] is a poignant and sensitive account of one of America's oldest scientists. However, I am wondering if Mr. Collier is aware that astrophysicist Dr. Charles Greeley Abbot is not the only working scientist who has passed the century mark. Some forty miles away in Maryland, at Owens Mills, Dr. E. Emmet Reid, professor emeritus of Johns Hopkins University, continues his chemical research and technical writing. At ninety-five, Dr. Reid tackled the problem of how best to extract technical knowledge from foreign languages and, undaunted by his lack of reading vision and impaired hearing, published at ninety-eight his book *Chemistry Through the Language Barrier.* These two visionaries, Dr. Abbot and Dr. Reid, almost identical in years, have in common originality and striking personalities. Of them it may well be said—they endure.

Alfred Gray Reid
San Francisco, Calif.

Struggling With Age

Dr. Lewis Thomas's "Guessing and Knowing" [*SR of The Sciences,* January] was a fascinating article with many valuable insights. However, I am impelled to question Dr. Thomas's assumption of the insuperability of the aging process. It would seem much more constructive to hold the view, until proven otherwise, that the mechanisms of "normal" aging are just as open to intervention as the mechanisms of disease. Our own aging and "natural" death are the worst misfortunes that most of us will suffer. It behooves us not to give in without a mighty hard fight.

Charles E. Cohn, Ph.D.
Clarendon Hills, Ill.

Editor's note: This month's cover story deals with the fight to halt the aging process.

Spiritual Life After Death

Dr. Robert Kastenbaum's article "The Kingdom Where Nobody Dies" [*SR of The Sciences,* January] compels me to express sadness that so many "orthodox" psychologists are unaware of—or choose to ignore—proof, provided by the late Arthur Ford and many other honest and reliable psychics, that the human mind and personality survive the abandonment of the physical body, which we call "death." Scientists should objectively investigate and evaluate the overwhelming evidence that there is no death of the mind and spirit and that "physical death" is not the final event in an individual's life.

Sidney G. Morton
Richmond, Va.

An Empty America

Professor Kenneth E. F. Watt wrote an excellent article, "A Movable (Disappearing) Feast" [*SR of The Sciences,* February]. In it he gave laymen a clear understanding of the most often unclearly presented subject of ecological energy. But because Professor Watt wants fewer babies and people to inhabit the massively empty United States (only seventy persons per square mile in our rural areas, which I call an empty America), he was unable to resist the temptation of committing a discriminatory fulmination against babies and people.

Anthony P. Cima
Los Angeles, Calif.

Concealed Sources Reveal Bad Judgment

It is puzzling to me why—among scientifically oriented resolutions (preservation of habitats, inappropriateness of religious beliefs when proposed for inclusion in science textbooks)—there should appear endorsement of a refusal to reveal sources ["Annual Anthro Ritual," *SR of The Sciences,* February]. There is an anachronism, as I see it, embodied in support for a reporter who wishes to preserve the anonymity of individuals whose personal statements draw important scientific conclusions, combined with the view that this constitutes a "grave threat to scholarly research." To this scientist-reader, the reverse position is stronger. Rendering a report or a judgment *without* revealing sources is *un*scientific and *un*scholarly.

Lincoln Pettit
Professor, Natural Science
Michigan State University
East Lansing, Mich.

Futile Search for Magnetic Monopoles

I believe that the search for magnetic monopoles is futile. ["Stalking the Mysterious Monopole," *SR of The Sciences,* February.] There is no reason to think that such particles exist, despite Dirac's argument. Magnetic fields are accepted to be the result of electric fields in motion, and we don't have to look any further for the reason for the close analogy between magnetic and electric effects. In a paper I recently submitted for publication, I have shown that it is plausible to consider that magnetic forces are analogous to the Bernoulli forces of hydraulics—for example, to the force that supports an airplane in flight. In this view magnetic fields are simply the change in the effective electric fields, which are analogous to the static pressure associated with motion of the electric fields.

Sidney Bertram, Ph.D.
Woodland Hills, Calif.

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EDITORIAL

The Patient's Bill of Rights

On January 8 of this year the American Hospital Association published a "Patient's Bill of Rights," covering what the association calls the most commonly questioned situations that patients encounter in a hospital. In the following guest editorial, Dr. Willard Gaylin, cofounder and president of the Institute of Society, Ethics and the Life Sciences in Hastings-on-Hudson, New York, argues that the prerogative to define patients' rights lies elsewhere.

A stay in a hospital exposes an individual to a condition of passivity and impotence unparalleled in adult life, this side of prison. You are dressed in an uncomfortable garment, leaving you exposed and ludicrous; told when you must sleep and when you must rise; informed of what you may eat and when you have to eat it; notified as to when you can have visitors, who they shall be, and how long they can stay. You are discussed in the third person in your presence as though you were some idiot child or inanimate object. If you are unfortunate enough to have an interesting case, you will be presented to a group of strangers who may take the invasion of your privacy as their privilege. Your chart, at the foot of the bed, will contain all the vital information that you would seem to be entitled to have; yet, should you attempt to examine it, you will be treated like a prepubescent caught with a copy of *Portnoy's Complaint*.

Some of this may be necessary for health and some for convenience, but most of it is simply the inevitable result of an authoritative person dealing with people who unquestionably accept his authority.

Hospital regulations are endured by a patient conditioned to seeing his physician as a benevolent father in whose reassuring presence he is prepared to play the role of the child. Beyond this, however, more serious rights are violated under the numbing atmosphere of the same paternalism.

Modern scientific medicine, as exemplified in complex teaching hospitals, has advanced technical skill at the cost of personal warmth. Often there is no one physician rendering care, rather a battery of specialists, and while "treatment" may be superior, "care" is absent. This depersonalization of medicine is having a predictable effect on the patient, causing him to abandon his tendency to romanticize the physician, and, by extension, the medical community. For this and other reasons the patient is now pressing for a reevaluation of the medical contract.

In response to this, the American Hospital Association recently presented, with considerable fanfare, a "Patient's Bill of Rights." It is a document worth examining, for nothing indicates the low estate of current hospital care (as distinguished from treatment) more graphically than the form of the proffered cure.

The substance of the document is amazingly innocent of controversy. It affirms that "the patient has the right to considerate and respectful care" and, beyond that, the right to "reasonable continuity of care." He is told that he may expect a modicum of personal privacy; that the usual medical concern for confidentiality should be respected; that he has a right to expect "a reasonable response" to his request for service; and, as in any other commercial transaction, that he has a right to receive an explanation of his bill.

In addition, he will be relieved to hear that, as a patient in a hospital, knowledge of the "rules and regulations" that apply to him is manifestly his due—just as it would be if he were a participant in a poker game. Similarly, the right to obtain information "concerning his diagnosis, treatment and prognosis" seems perfectly straightforward—no more than the minimum required of any standard commercial transaction. On the other hand, the patient's right to "obtain information as to any relationship of his hospital to other health care and educational institutions in so far as his care is concerned" is disquieting, for it anxiously suggests that while his exclusive reason for being in the hospital is his personal health, the hospital may have multiple, unstated other reasons influencing its treatment of him.

Finally, when the bill affirms the patient's right to "give informed consent prior to the start of any procedure," his "right to refuse treatment to the extent permitted by law," and his right to be advised "if the hospital proposes to engage in or perform human experimentation" on him, it seems to be merely belaboring the obvious. It says no more than that the hospital is subject to the same laws concerning assault and battery as any other institution or member of society.

The objection to this well-intended, though timid, document is that it perpetuates the very paternalism that precipitated the abuses. By presenting its considerations as a "Patient's Bill of Rights," it creates the impression that the hospital is "granting" these rights to the patient. The hospital has no power to grant these rights. They were vested in the patient to begin with. If the rights have been violated, they have been violated by the hospital and its hirelings. The title a "Patient's Bill of Rights" therefore seems not only pretentious but deceptive. In effect, all that the document does is return to the patient, with an air of largess, some of the rights hospitals have previously stolen from him. It is the thief lecturing his victim on self-protection—i.e., the hospital instructs the patient to make sure that the hospital treats him according to the rules of decency and law to which he is entitled. It would be more appropriate if the association addressed its 7,000 member hospitals, cautioning them that for years they have violated patient rights, some of which have the mandate of law, and warning them they must no longer presume on the innocence of their customers or the indifference of judicial authorities.

Since this is a patently decent document, the fact that the American Hospital Association takes the circuitous route of speaking to the patient of his rights, rather than to the hospital of its duties, reveals the essential weakness of such professional organizations. The AHA, like the American Medical Association and similar groups, is designed to be the servant of its constituent members—and not of the general public. A servant does not lay down the law to his master. In this regard the AHA can only state that it "presents these rights in the expectation that they will be supported" by the member hospitals. The fact that it feels the need to alert the patient indicates how insecure that "expectation" is.

A reevaluation of patient rights—one that goes beyond the old rights reaffirmed in this bill—is greatly needed. The public should not look to the professional association for leadership here. It is not for the hospital community to outline the rights it will offer, but rather for the patient consumer to delineate and then demand those rights to which he feels entitled, by utilizing all the instruments of society designed for that purpose—including the legislature and the courts.

WILLARD GAYLIN

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SMOKEY'S MID-CAREER CRISIS

BY RICHARD J. VOGL

FIRE IS ESSENTIAL TO THE HEALTH OF MANY PLANT AND ANIMAL COMMUNITIES. NONETHELESS, SMOKEY THE BEAR AND HIS HUMAN ALLIES, RELYING MORE ON PYROPHOBIA THAN REASON, CONTINUE TO STAMP IT OUT INDISCRIMINATELY.

Two decades ago, following a furious forest fire in New Mexico's Lincoln National Forest, rangers found a small bear with burned feet wandering near the scene of the holocaust. They saw it as a symbol of nature crying out to man for help against the ravages of fire. The idea ignited the imagination of a public-relations-minded employee of the U.S. Forest Service, and the bear became a sort of ideological mascot. Out of this adoption there grew one of the largest, longest, and most effective propaganda campaigns in American history, the Smokey the Bear program.

Until recently, scientific literature on the effects of fire on animals consisted mostly of accounts of fire mortality. Fires were generally described as detrimental or lethal to most wildlife species. It was particularly easy to accept this, since most of us were conditioned during childhood by stories and pictures of Bambi, Smokey the Bear, and the like that play up the evils of fires. Once the Smokey the Bear machinery was set into motion and aided by such organizations as Walt Disney Enterprises, a new breed of scientist-biologist appeared, completely indoctrinated in the philosophy that fire is always destructive. These individuals, as well as the public, came to believe *a priori* that all fires were bad and tended to dismiss studies that demonstrated the beneficial effects of fires. Such studies were even regarded as threats to the foundations of our society. Who could believe, as we sat securely on mother's lap and listened to the story of Bambi, that we were being pumped with a great deal of nonsense? Who could mistrust the honest-looking, clean-cut man wearing a green uniform and badge who visited our fifth-grade class and told us about Smokey the Bear and the destruction wrought by forest fires (a program that is still fully underway with all of its misinformation)? Was he pushing a line of half-truths because he believed it intrinsically, or did he assume that we were too naïve to handle the whole truth?

Given fire's historic importance to

Richard J. Vogl is professor of biology at California State Univ., Los Angeles.

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man, this official vilification of burning that began in the 1930s seemed shockingly sudden to some naturalists. In the space of a few years fire fell from a valued friend and tool to an insidious enemy and aggressor. Whereas early man struggled to start and spread fires, modern man suddenly switched to a costly—and largely unsuccessful—effort to prevent and suppress them. We quickly dismissed man's traditional worship of fire as superstitious nonsense, ignoring the wealth of empirical knowledge that lay at the core of the mythology he created.

Primitive man understood and used fire just as he did other aspects of his environment. He not only managed it well enough to avoid burning his own villages but also used it for hunting, to improve grazing for domestic stock, to clear areas for cultivation, to create fertilizing ash on fields, to favor certain plant species over others, to facilitate the harvesting of certain crops, and to eliminate harvest residues and weeds. In what is now the United States, for instance, Indians knew that the easiest way to promote the flowering of chia, a favorite seed-producing plant, was by igniting fields where it grew; this stimulated seed sprouting and eliminated competition. They found acorns by burning off the concealing grasses around oak trees. They also used fire to communicate, to control insect pests and plant diseases, and to reduce the threat and intensity of uncontrolled fires.

Man's abrupt change of attitude toward fire and its use, particularly in the biological world, was essentially a reaction, or overreaction, to the reckless and promiscuous burning of plundering pioneers, settlers, and early entrepreneurs. The first Europeans to tap American resources were overwhelmed by their abundance. Centuries-old habits of constructive conservatism were instantly discarded as these aggressive new Americans got into the habit of putting the torch to whatever confronted them or whatever they left behind.

During the 1930s, which featured years of drought, failing farms, and widespread forest fires, the pendulum began to swing back. The dust bowl of the "Dirty Thirties" hastened the swing and the growth of fears that soon there would remain no vegetation on the continent. Although a handful of land managers and research biologists warned of ecological backlashes if fires were ex-

Fire has been excluded from such areas as Yosemite National Park (left) for more than seventy years. Now jungles of white fir and incense cedar compete with climax species such as ponderosa pine and Sequoia. The larger trees are weakened by the competition, becoming more susceptible to pests. The combination of dense undergrowth, thick accumulations of forest floor litter, and weakened trees provides an ideal setting for destructive crown fires (center). If natural fires, which reduce the buildup of undergrowth and litter, are prevented, the result can be the kind of inferno that blackened about 10,000 acres of Indian reservation land (right) in Arizona in 1971.

The health of many plant and animal species depends to a surprising extent upon fire. The most common natural cause is lightning. When lightning fails to strike, however, man may imitate nature. While some old-timers still use matches or a rake filled with burning embers, the most common tool is a drip torch (left) filled with gasoline and fuel oil; the oil sticks to vegetation and increases ignition. Controlled surface fires (center) reduce fuel loads so that damaging crown fires are unlikely. Southeastern Arizona's virgin ponderosa pine forest (right), swept by frequent, small lightning fires, contains elk, bear, deer, and turkey, as well as large, healthy trees.

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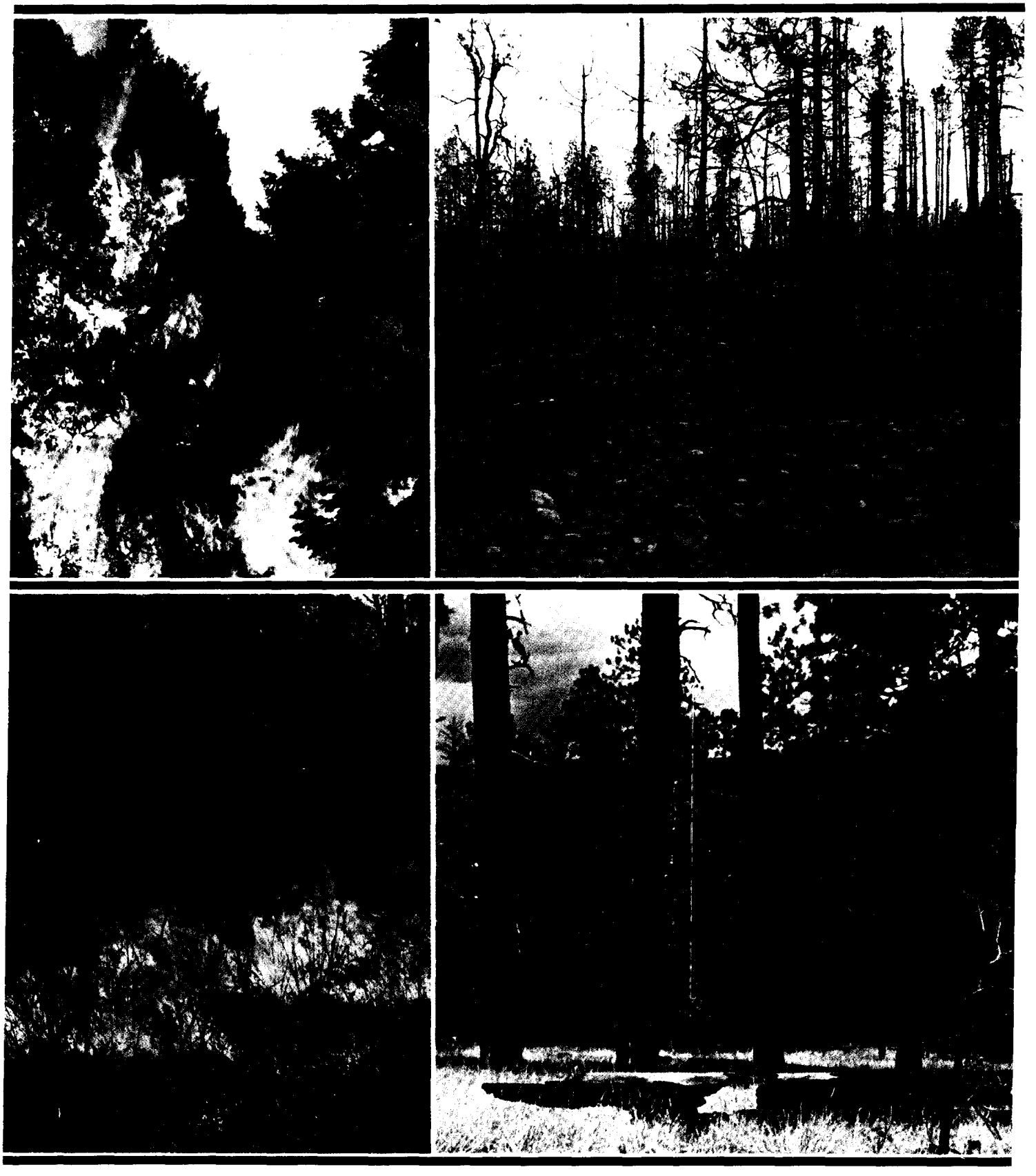
Most natural communities have learned to live with fires on a regular basis.



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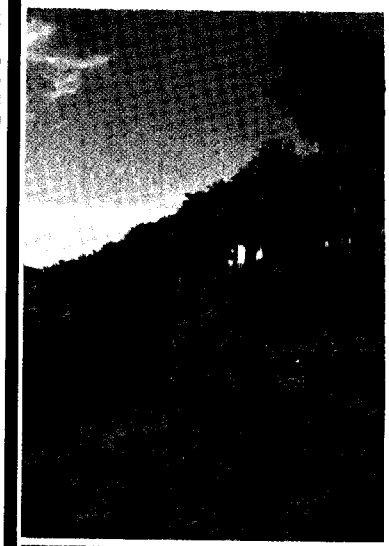
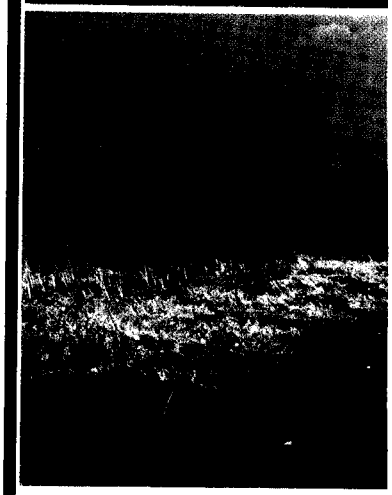
Lightning-set fires often burn between or after rains, causing little damage.





Desert oases of the California fan palm (top) are rejuvenated by fires and floods. These natural catastrophes thin the growth of competitive oasis plants, leaving the fire-tolerant palms adequate space for growing and reproducing. After the winter burning of a Florida lake shoreline (above), animal censuses were taken of the burned area and of an adjacent unburned stretch of shore. For five months after the fire the burned region attracted 3.2 times as many song- and shorebirds as did the controlled region.

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cluded from certain vegetation types, they were ignored. A few studies appearing in scientific journals reported that fire suppression caused ecological changes or abnormally severe wildfires. But such studies and their subsequent publication were increasingly suppressed, and the scientific record since the advent of fire protection consists primarily of accounts of the detrimental effects of fires. Professor John T. Curtis wrote the following in his book *The Vegetation of Wisconsin* (1959):

"Not only the grouse harvest but the blueberry crop as well have become victims of the bureaucratic dictum, that since most forest fires are the source of economic loss, therefore all fires are bad and must be prevented at any cost. This dogma has been supported by such an intensive propaganda campaign that there is danger of its being accepted as truth . . . . The logical solution to the problem lies in the acceptance of the quantitative evaluation of fire rather than its complete condemnation."

The truth is that most of our natural communities have "learned" to live with fires on a regular basis. They may burn as often as every year or two, as did some Sequoia and ponderosa pine forests, or as rarely as every 100 years, as does the high-elevation chaparral in California. Even the Arctic tundra burns occasionally, and these rare fires have essential functions. Regular lightning-caused fires tend to remain near the forest floor, removing the litter and fallen branches but causing little damage. When fires have been suppressed for decades, however, allowing dense accumulations of forest litter and undergrowth, a fire readily becomes a holocaust, ravaging the highest crowns and killing even the large trees.

Countless animals and plants rely upon fire to maintain habitats in a healthy state. Deer rest and feed in the open spaces cleared by fire in and around forests. Elk once wintered in valleys kept clear by fire. Many shorebirds, waterfowl, and songbirds need treeless spaces to feed and nest; cattail marshes, if unburned, become impenetrable for the herons and rails that live there. Muskrat catches in the productive areas of Louisiana and Maryland fell dramatically after Smokey the Bear prevented the trappers' customary burning of decadent vegetation after each season. Woodcocks and quail cannot forage on a forest floor that accumulates more than about six inches of litter, and their numbers are dropping in fire-free areas.

Plants as well as animals depend upon fire for good health. Douglas fir and ponderosa pine, respectively ranked the number one and two lumber trees in the West, both feature life cycles intimately linked with fire. A bark beetle that is attacking the ponderosa pine throughout the West was seldom a problem before fire suppression in the 1930s; a forester in the Northwest, who prefers to remain anonymous, has found that bark beetle and other forest insect troubles began to build up after the last natural fires. Other forest insects and diseases, including the *Fomes* fungus that causes heart rot in most trees, have been on the rise since the suppression of fire. Reproduction and growth in many grasses, forbs, shrubs, and trees are inseparably linked to fire.

The following example illustrates the intentional or unintentional bias against fire that is still encountered today. In 1969 I submitted the results of a research project on the beneficial effects of wildfire on white-tailed deer populations to a major scientific journal. The paper was quickly rejected on the basis of comments by an anonymous reviewer, who stated:

"My basic criticism is that the paper has been submitted for publication in [this journal] where relatively few of the readers will have the background necessary to interpret the facts that are presented. To such an audience the implications drawn from this paper can be very misleading. The paper gives evidence that, after eight or more years, 2.4 times more deer used a forest area in northern Wisconsin that was heavily burned by uncontrolled fire than used an adjacent area which originally was ecologically comparable. Even though it is explicit that this is a specific study conducted in northern Wisconsin, the implications to those who have no training in this field, I believe, will be that America is much better off with heavy uncontrolled fires."

This reviewer either believed that the scientific community was also too naïve or stupid to handle the whole truth, or could not see beyond his reluctance to admit that any wildfire might have beneficial effects. Most of my colleagues involved in fire research tell of similar occurrences, and more than one ecologist has been drummed out of his job or even profession for defying the political current set up during the halcyon days of Smokey. One case that is well-known among fire researchers involved an ecologist who proved that cattle in the Southeast grow three times faster on pine savannah that has been burned regularly than they do on pine savannah that has not been burned. Because this man insisted that his data were correct and should be published, he lost his job as a range scientist with the U.S. government and spent the rest of his working days selling veterinary supplies.

In the last few years, fortunately, there has developed an unprecedented interest in discussions of fire and in fire research. In the past two years, for example, fire conferences or symposia have been held in Alaska, Arizona, Colorado, Florida, Minnesota, South Carolina, and Texas, sponsored by public as well as private agencies with both academic and applied interests. In addition, a number of popular articles attempting to combat the one-sided Smokey the Bear propaganda have appeared recently in such lay publications as the *Wall Street Journal*, *Time*, *Sports Illustrated*, *Outdoor Life*, *Smithsonian*, *Naturalist*, *Living Wilderness*, *Reader's Digest*, and *Ecology Today*. As a result, a part of the adult public has finally been made aware of the propaganda, extremism, and prejudice that they have been subjected to regarding fire interrelationships.

Again the pendulum has started to swing, after being stuck to one side for more than forty years. The recent movement has resulted largely from the efforts of a few persistent investigators, among them Professor Harold Biswell and forester Harold Weaver, who continued to conduct and publish objective research on fire and champion the "fire cause" whenever possible. These results not only influenced the thinking of academic ecologists, researchers, and teachers but also affected those scientists employed by the government, including the Park and Forest Services. These latter investigators applied pressure from within the organizations most responsible for the formulation and implementation of fire-exclusion policies.

As a result of all this internal stirring —aided by the ecology movement and the efforts of such organizations as Florida's Tall Timbers Research Station, —changes have begun to occur. Interest in the use of controlled fire as a management tool has increased, and

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plans to let naturally occurring fires take their courses in low-risk areas have become realities. Land managers, particularly in the Southeast, have become interested in reinstating fire in those regions where fire exclusion has resulted in abnormal fuel buildups that will only lead to catastrophic fires, disease problems, insect infestation, inferior timber growth, deteriorated grazing conditions, reductions in wildlife-carrying capacities, and diminishing watershed yields. Such fires should be introduced whenever conditions are favorable for light and controllable fires, rather than waiting for the inevitable man-caused fires that usually spread unchecked during extremely dry conditions. Lightning-caused fires in grassland, chaparral, and forest, for example, used to burn naturally after and between the rains that accompanied the lightning. We have become so accustomed to witnessing drastic wildfires only under the worst conditions (at other times the fires are quickly and completely suppressed) that we now think this is the only time they can occur. Many Southern California land managers, for example, believe that chaparral will burn only under the driest of conditions, when it is too dangerous and difficult to control. This error is understandable, since they probably do not remember the natural behavior of fire before the advent of universal fire suppression.

In spite of all the recent interest in fire as a natural and essential part of many environments, there is still a long way to go—politically as well as ecologically—before North American fire-type environments are again in balance. In fact, there is a good chance that as discussions continue, many land managers and administrators may talk themselves out of attempting to reinstate fires under any circumstances. Reasons for the reluctance to use fire as a tool or to let natural fires burn are numerous. Definite credibility gaps exist between research, management, and administration. Even if the "facts" dispensed in the current Smokey the Bear campaign were adjusted to present a complete and truthful picture of fire, we would still have to go through several generations of future scientists, managers, and administrators before unbiased individuals would dominate the scene. Certain key administrators now in power have dedicated their lives to fighting fires. They have lost friends to fire and have made it a personal enemy. These men accept the results of scientific studies reluctantly, if at all.

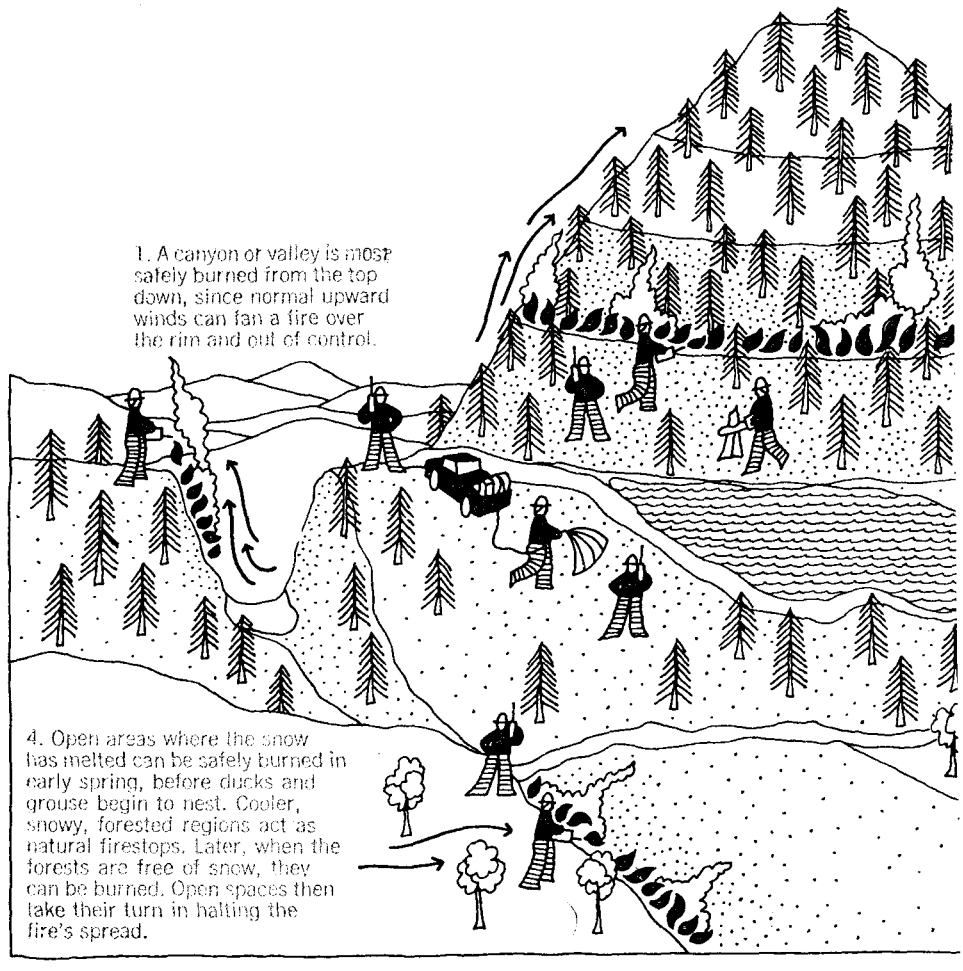
Such men throw up a wide variety of objections to fire use, under the overriding premise that fire is inherently bad. They argue, for example, that heavy soil erosion is produced by burning. It is true that fires can, on occasion, accelerate erosion, particularly the man-caused fires that are extra-severe because of abnormal fuel buildups and vegetation decadence. However, erosion is nonexistent or negligible after light controlled burns in both mountains and plains.

In any event fires usually do not *cause* the erosion; it is caused by uplifting, steep slopes above the angle of repose, water cutting, and the gravitational movements of substrate materials. In many parts of the West, for example, mountains are uplifting and valleys and plains are subsiding, and as long as this continues (if it stops, the planet Earth will cease to function) there will be erosion with or without fires.

Other burn opponents say that fires must be harmful because they remove essential nitrogen from the soil. Again, studies have shown that the nitrogen content of many burned soils is higher than that of unburned soils, the plants that grow there are greener, and certain algae, bacteria, and fungi are much more abundant and active.

For a long time such complaints about the use of fire could not be easily refuted, because of the lack of research. Who would approve or undertake research on a question that had already been resolved at the time of the birth of Smokey the Bear? Hence, we have little scientific knowledge of the art of burning—when and where to ignite a forest or grassland. Until recently, those who wanted to explore this art had to operate in the face of strong opposition and the chance of losing their jobs. Our overall reluctance to experiment with fire has been reinforced by the creation of Arbor Day, by Scout crusades to plant pine trees, by FHA requirements for a tree on every building site, and by such forestry-encouraged concepts as "only God can make a tree." Forgotten is the fact that countless species of wildlife cannot continue to exist in unburned forests, that forest trees need

CONTROLLED BURNING, like burning or hunting, is a much-acquired skill and a scientific technique. Areas should be clamp with a cool rain, burning should be done in late afternoon, since nightfall brings coolness, dew, and ideal fire-quelling conditions. Four variations:


1. A canyon or valley is most safely burned from the top down, since normal upward winds can fan a fire over the rim and out of control.
4. Open areas where the snow has melted can be safely burned in early spring, before ducks and grouse begin to nest. Cooler, snowy, forested regions act as natural firestops. Later, when the forests are free of snow, they can be burned. Open spaces then take their turn in halting the fire's spread.

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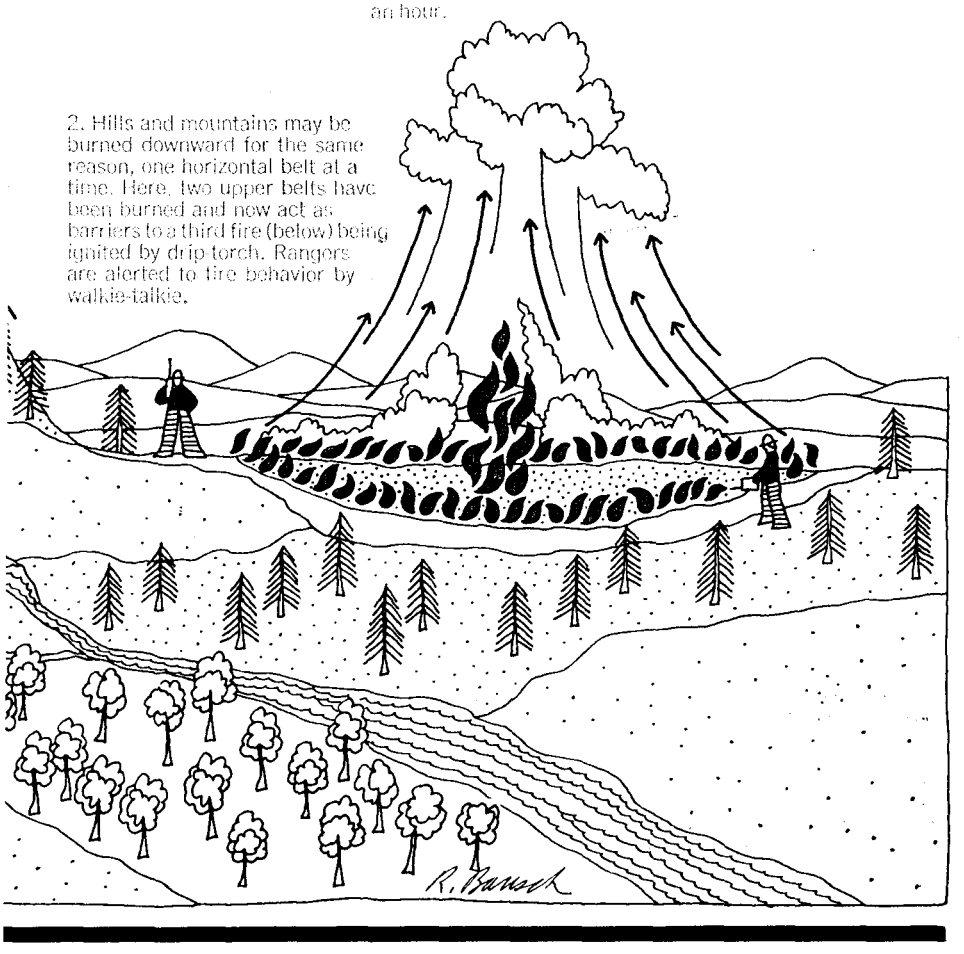
3. The most common—and spectacular—method of burning begins from ridge or mountaintop. Setting a series of fires, strategically placed, the burner lights the first fire. As the fires begin to "spot" over a common center, powerful updrafts hasten the burning and form a towering mushroom cloud of smoke. The fire may be out in an hour.

2. Hills and mountains may be burned downward for the same reason, one horizontal belt at a time. Here, two upper belts have been burned and now act as barriers to a third fire (below) being ignited by drip torch. Rangers are alerted to fire behavior by walkie-talkie.



fires for their continued healthy existence, and that man is primarily dependent upon grassland crops and livestock for his livelihood. As a result, contributions of lands or funds for fire experiments have been practically nonexistent, and even if they were available, many administrators would balk at using them because of their basic fear of fire.

On a more practical level, foresters have been restrained from using fire as a management tool by the present legal situation. Land owners, managers, and administrators must incur heavy responsibilities if they are going to conduct controlled burns. A bad decision with fire can plunge them into legal and financial jeopardy, lead to loss of jobs, and create a disastrous public image. Thus we need a change in liability laws, as well as support and protection against legal difficulties. More importantly, the public must be well informed about the true role of fire in nature. In their present panicky state, they will never support controlled burning programs.

I still remember my reception when I came to California from Wisconsin in 1961. As a new faculty member, I was required to give a seminar on any subject I chose, and I picked the use of fire as a management tool. At the end of the talk, the men in the last few rows of the room erupted with questions that aimed at discrediting everything I had said. They turned out to be from the Forest Service, and even though I thought I answered every one of their objections, they insisted upon having the last word. "That may work in the Midwest," they said, "but it won't work in California"; or, "It may be good for animals, but it sure will ruin the soil." Some of my own colleagues, who had also been educated by Smokey and Bambi, were rather uncertain about my interests, sometimes calling me "pyro."

Perhaps the strongest block against the use of fire is the heavy commitment in funding, equipment, and personnel by the fire-fighting fraternity. To this establishment, stamping out fire has become a gainful, enjoyable, and deeply entrenched business, and they oppose controlled burning programs because they feel that the need and funding for their services will be reduced. Present fire allocations, as well as the price tags put on actual fire suppression and wildfires, have reached pork-barrel dimensions and are often raised without question. Since forest fires are emotionally condemned as evil threats to our society, their suppression is unanimously supported—almost as automatically as Congress voted funds for Vietnam during the early days of the war. The cost of fighting many wildfires is directly proportional to the length of time that fires have been excluded, and damage estimates often include extravagant fire-fighting expenses. Interestingly, fears of job losses by fire fighters may be unfounded, since controlled burning programs would employ these foresters in a far more constructive way.

One high-priority challenge for these men should be to become expert at fire use. During the reign of Smokey, we have almost forgotten not only the technique of controlled burning but the legendary men who practiced it. Most of them, like Herbert Stoddard, who used to burn off a thousand acres singlehandedly with nothing but a hand-cooling towel under his arm, are retired or about to retire. The Komarek brothers, who probably know more about burning in the Southeast than does anyone else, could burn circles around a parked car without blistering the paint. Norman Stone and Burt Dahlberg fire-managed Wisconsin's Crex Meadows Wildlife Refuge into a wildlife showcase. Harold Weaver and Harry Kallander gathered much of their expertise from native Indians in Oregon and Arizona.

Apart from this handful of master burners, few men remember the days of controlled burning. The chain of empirical knowledge has been broken, and the know-how that was passed from generation to generation is largely lost. If modern man wants to continue to survive, he will have to live in harmony with the land and everything that comprises the environment, including fire. This means relearning the lost art of the aborigines of using fire as a tool and dismissing our recent, self-inflicted fear of fire. Beliefs now common among administrators that fire is "too scary" or "impossible to use" must disappear. But first of all—perhaps by reshaping the mission of Smokey the Bear—we must succeed in reminding ourselves that fire is just as much a part of nature as is man. □

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JOHN BARDEEN: A PROFILE

BY WILLIAM K. STUCKEY

THIS UNIMPOSING SCIENTIST FROM THE CHILLY FLATS OF THE AMERICAN MIDWEST IS THE ONLY PERSON EVER TO WIN TWO NOBEL PRIZES IN THE SAME FIELD. HE JUST MAY WIN A THIRD.

SINCE THE NOBEL PRIZES were first awarded in 1900, only one person has ever won two in the same field. Of course, Marie Curie won two prizes, but in different fields—first in physics, then in chemistry. Linus Pauling also has been twice honored—first for chemistry, then for peace.

But to take the prize twice in physics, the queen of the sciences—this was the feat of a rather plain, unimposing man from the chilly flats of the American Midwest. John Bardeen, professor of physics at the University of Illinois, is one of the handful of men who made this century the electronic century. And he may well become the principal technological architect of the next.

In 1956 Bardeen captured the Nobel Prize in physics for his contribution to the development of the transistor ["Happy Birthday, Transistor," *SR of the Sciences*, January]. Last December he returned to Stockholm to receive his second physics laurel, this time for his role in unraveling a mysterious phenomenon known as superconductivity.

For the second time in his life Bardeen found himself in the atmosphere of majesty and elegance that always accompanies the awarding of the Nobel Prizes. Trumpet calls, bows and curtsies, ribbons and medals, white ties and tails—these are the sights and sounds of Stockholm during Nobel Week, when those being honored are presented to members of Swedish society. The laureate corps always contains interesting faces for the elite to look at and highly accomplished hands to shake; 1972 was no exception.

Swedish eyes immediately locked on Christian Anfinsen (chemistry, United States), a tall, rugged man with wrinkled yet open features who resembles Spencer Tracy. Then there was John Schrieffer (physics, United States), cheerful and boyish as an astronaut; Heinrich Böll (literature, Germany), melancholy, tortured, humane—the tragic poet; and William Stein (chemistry, United States), paralyzed from the neck down, who flew halfway around the world in a wheelchair to receive his award.

Against such a background of impressive figures, John Bardeen might be easily overlooked. He is a squarish man of medium height, with flat eyes of an indeterminate color—probably blue or brown—covered by outdated plastic-rimmed glasses. At sixty-five Bardeen is almost bald, with a ring of dull, straight hair about the back of his head. His voice, which he rarely uses, maintains a relentless monotone, changing pitch only when it cracks. There is nothing sharp or outstanding about him. He is not at all what one expects of a giant of science and technology. Even the large contingent of shy sons, pleasant daughters-in-law, and bright grandchildren who followed him to Stockholm failed to make more than a slight initial impression on the elegant Swedes.

It is the fanatical corps of Bardeenists—the ex-students, the coworkers, the key silent men in the international Nobel apparatus—who support the legend of Bardeen the scientific giant. What other living man, they ask, has so greatly affected the daily existence of so many human beings? His work on the transistor alone made space exploration and pan-planetary communication possible, brought into being an exotic array of sensitive new medical instruments and incredibly fast computers, and opened the way (for better or for worse) for the oncoming digitalized society. The ultimate McLuhanesque revolutionary device, the transistor made possible cheap radios that spewed not only entertainment but news, education, and propaganda to the isolated and illiterate, from the Arabian Desert to the Amazon basin.

But there is more to the Bardeen ledger of accomplishment. Working with Gulf Oil in the 1930s, Bardeen found ways to read nearly imperceptible magnetic clues in various rocks and soils—clues that indicated where the vast oil pools were. The method remained a tight company secret for decades, but when it finally leaked out, the Bardeen technique was grabbed by virtually the entire oil industry. Bardeen also was highly instrumental in the development of the electronic copier, having served as corporate advisor and scientific consultant to Xerox since 1951. Without the high-speed Xerox, the "information explosion" in government, industry, science, and education would have been little more than a small pop. Bardeenists note that an unexpected side effect of rapid copiers was to make government secrecy more difficult to maintain. Would the Pentagon Papers have surfaced, they ask, if Daniel Ellsberg had been forced to photograph those thousands of pages or copy them by hand?

But this is only Bardeen the inventor, the Thomas Edison of the twentieth century. No matter what the impact of technological innovation, fundamental science is always of more interest to the Swedes of the Nobel apparatus, and

William K. Stuckey is currently writing a book about the Nobel Prizes.

ILLUSTRATION BY MARTY GINSBURG

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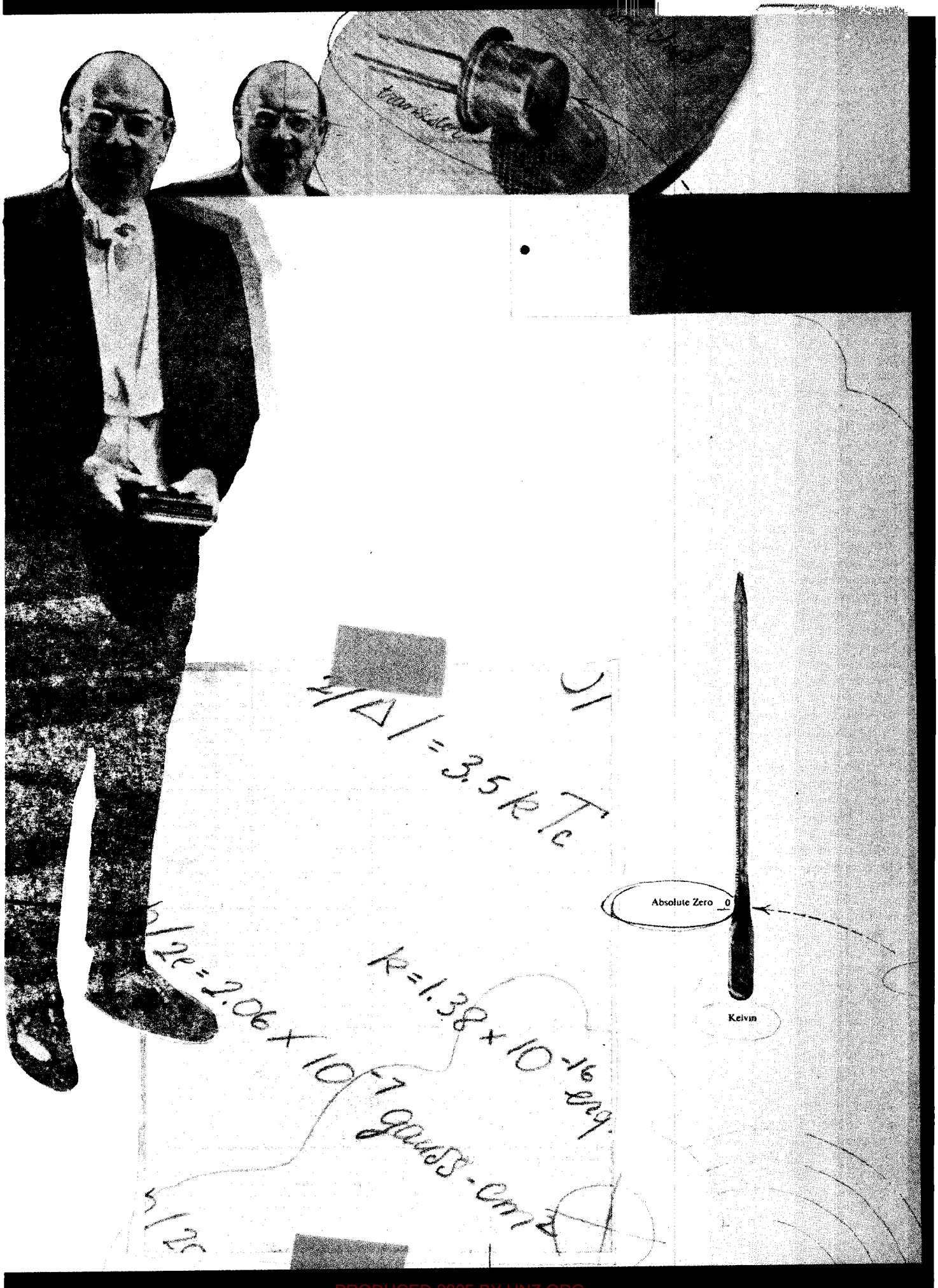

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Bardeen posted an impressive score in this area as well. With the BCS (for Bardeen, Cooper, and Schrieffer) theory of superconductivity, he resolved one of the major problems in pure physics of the century.

In 1913 the Swedes awarded the physics prize to the Dutch scientist Heike Kamerlingh Onnes for his discovery that when certain metals were cooled almost to absolute zero, resistance to electrical flow (the movement of electrons) in the metals all but disappeared. The supercooled metals were transformed into extremely efficient, almost perfect *superconductors* of electricity. Kamerlingh Onnes was amazed to find that a single charge of electricity pumped into superconducting metal would race around for hours without losing any of its force. (By the 1960s MIT physicists reported that such a charge would last undiminished for more than a year in certain superconductors.) But Kamerlingh Onnes could not explain why this phenomenon occurred; nor could a dazzling host of later Nobel laureates—Bohr, Heisenberg, Pauli, Bloch, Landau, Feynman—who were convinced that basic but strange laws of matter were operating here. The activity of electrons in a supercooled metal was the closest thing to perpetual motion that had been observed on earth; it held the promise of endless supplies of electrical energy. Moreover, physicists hoped that the flow of electricity through this supersmooth realm would give them another point of view from which to observe the mysterious, ephemeral electron—the orbiting ghost, now a wave, now a solid particle.

Later on W. Meissner and R. Ochsenfeld discovered another feature of superconductors that suggested a number of genuinely earth-shaking applications: the entire supercooled metal would repel outside magnetic fields. In other words, if a magnetic material was placed over a superconductor, it would hang there suspended, in an apparent state of levitation.

John Bardeen was born in 1908, about the time that Kamerlingh Onnes was working in Leiden, puzzling over superconductivity and reporting to the small world of physicists that he was producing the coldest laboratory temperatures yet. The son of a professor of anatomy and dean of the University of Wisconsin Medical School, the young Bardeen showed more than an ordinary interest in the educational toys of his day—crystal radio sets, popularized chemistry books, the ubiquitous chemistry set. He attended an experimental elementary school in Madison, where he jumped from the third grade straight to the seventh. Shy, but not a loner, Bardeen was exceptionally good in mathematics and exceptionally tight with words; a congenital tremor in his body made it difficult for him to speak. Despite this condition, he won two letters in swimming and was quite proficient at billiards. A walking incarnation of the Midwestern ethic—work hard, be kind, and do right—Bardeen took a black-and-white approach to the most difficult intellectual problems, breaking them into their simplest components and solving them one at a time.

As most Bardeenists will note, Bardeen had one other interesting characteristic—he was almost always right, and not just in physics. Much later Professor David Pines of the University of Illinois, a colleague of Bardeen and a distinguished physicist himself, noted: "I really didn't quite realize that George McGovern wasn't going to be elected President until John Bardeen said George McGovern wasn't going to be elected President."

> Bardeen has the approach of an engineer: grab a problem and grind it into submission with twenty-hour days and brown-bag lunches.

Bardeen could not always explain how he arrived at the right answer. Ask him for his reasoning in problem solving, and Bardeen will probably respond: "That's the right answer because it is correct."

However, there is nothing mystical about Bardeen's instincts for the right answer. There is no cosmic vision that makes him spin out answers in out-of-the-blue images and alien symbols, in the manner of an Einstein or a Dirac. The mentality is that of an engineer. Grab a problem, inhale its every detail, and grind it into submission with twenty-hour days and brown-bag lunches.

In fact, Bardeen's first career choice was engineering. Although basic mathematics had its allure, engineering was the place where the practical problems (as well as the jobs) were. Soon after he left the University of Wisconsin with his master's degree in electrical engineering, Bardeen joined Gulf as a sophisticated oil prospector. By the depression year of 1933 he was making the then-handsome salary of $6,000 a year.

And then, suddenly, he quit. He announced that he was returning to basic science—pure quantum physics—and had signed up at Princeton as a doctoral candidate, to live on a graduate student's stipend of a few hundred dollars a year. Bardeen's hearty, down-to-earth business colleagues were amazed at this seemingly impractical move. (Of course, hindsight shows this decision to have been very practical indeed.) As for Bardeen, the switch was merely an extension of the work-ethic virtues that had been guiding him all along. Practical engineering techniques were fine for solving everyday problems of life. But in seeking the basic laws that govern matter and energy in the universe, one might find answers to *eternal* practical problems.

During the first days at Princeton, Bardeen, as usual, was easy to overlook. The grinding speech and the tremor in his hand often made for a painful first impression. Frederick Seitz, a fellow Princeton graduate student, now president of New York's Rockefeller University, made this observation: "The tremor was something that always threw off the stranger at first. Because of it, you didn't always realize how deep he was."

Nevertheless, Bardeen's persistence and grasp of fundamental problems of physics soon caught the attention of a very special man at Princeton, Eugene Wigner, one of the first European scientists to flee Fascism for American shores. He was an intimate of the brilliant mathematician John von Neumann, a leader in early computer development. But more important for Bardeen's career, Wigner was part of the international Nobel network—the laureates, the judges, and the well-connected professors who help choose Nobel Prize winners. Wigner is also the brother-in-law of the Cambridge physicist Paul Dirac, who developed the theory of antimatter. Dirac was the youngest man ever to win the Nobel Prize (thirty-one at the time), and other English scientists claim that he is the most brilliant British physicist since Isaac Newton. Aside from his membership in this tiny circle of men who dominated basic physics (and the Nobel Prizes), Wigner was among the handful of scientists who convinced Albert Einstein to write his famous letter to President Roosevelt that started the development of the first American atomic bomb.

Under Wigner's influence, Bardeen plunged deep into quantum theory, the new physics of the first part of this century that attempted to explain the extremely complex interchanges between matter and energy on an atomic and molecular level. In his flat and uncomfortable manner, Bardeen explains today that his interests quickly focused on superconductivity, not because of its magic, its promise of perpetual motion or levitation, but only because it was the outstanding problem of the day in quantum theory. For centuries swarms of colorful magicians, crackpots, mystics, and inventors scrambled in search of the world of levitation and perpetual motion, but Bardeen found it first, in the name of pure science. To Bardeen,

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choosing superconductivity for his life's work was simply the right answer.

Some of Bardeen's early work in superconductivity surfaced in 1941; but when the war came, he put it aside for conventional research in mine warfare and torpedoes. After the war he joined Bell Laboratories in a return to corporate practicality. At Bell Labs, Bardeen spent work-bruised years in the creation of the transistor, ending forever the use of the costly, low-speed vacuum tube. Bell had appointed the flashy, MIT-bred William Shockley to head the transistor-development group, but when the crash program was over, the government patent for the ideas behind the transistor was awarded to Bardeen and his now-retired coworker, Walter Brattain.

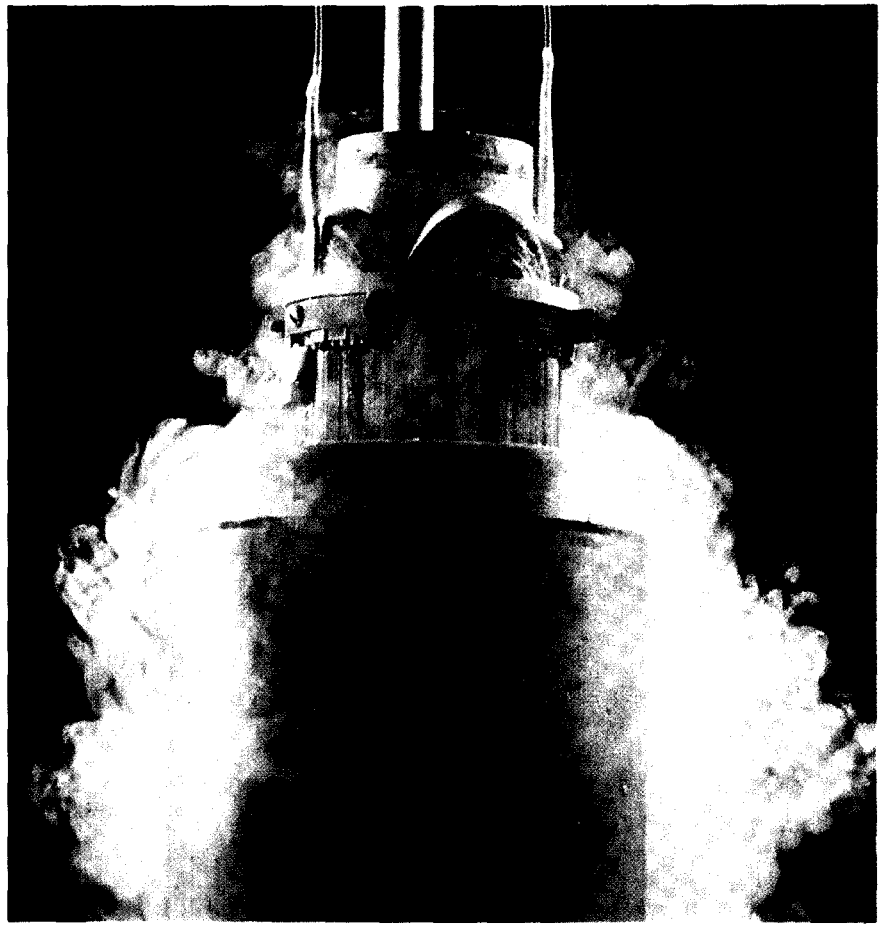
In 1956 Nobel immortalization came to all three, and it was Shockley who dazzled the Swedes at the ceremonies. A former student of Erik Rudberg, the well-mannered and pleasant man who now chairs the Nobel Physics Prize committee, Shockley was one of their own. (Swedish academics rarely mention Shockley today, however, because of his numerous public statements suggesting that blacks may be intellectually inferior to whites for genetic reasons). But the Swedish hosts finally noticed Bardeen and invited him to present a few scientific seminars around Stockholm. What would he like to talk about —the transistor effect and the electronics revolution it would bring?

"No," said Bardeen, mumbling something about superconductivity.

It was still on his mind. As a matter of fact, Bardeen had left Bell Labs five years earlier, in 1951, for the University of Illinois. A small university town isolated from the nerve-splitting strain of a metropolis, he reasoned, would be the best place for grinding and scraping away at the century's major unsolved riddle in physics. And since he was already well wired into the men who dominate the world physics culture, Bardeen could easily overcome the isolation of middle Illinois and acquire bright students, funding, and the outside ideas he needed to assault superconductivity.

As usual, Bardeen was right. It was at Illinois that he and two of his students—Leon N. Cooper, then a post-doctoral fellow, and John L. Schrieffer, then a doctoral candidate—unraveled the supersmooth secrets of the century-old problem. Both students are now themselves professors, Cooper at Brown University and Schrieffer at the University of Pennsylvania. But on December 10, 1972, all three were on the stage of the St. Erik Exhibition Hall in Stockholm to share the Nobel Prize in physics for the development of the BCS theory of superconductivity.

Bardeenists need no more evidence than this to claim that he is also a great



KEN KAY

A superconducting magnet, chilled to −452.2° F., rises from a refrigerating bath of liquid helium. The slightest input of electricity makes this magnet so powerful that it can be used to focus the 33-billion-electron-volt particle beams in an atom smasher.

Superconductivity—A Primer

The BSC, or Microscopic, theory of superconductivity, for which John Bardeen won his second Nobel Prize in physics, is a long and complex exercise in quantum mechanics. In simple terms, however, it can be described as follows:

Electric flow in a conductor begins when a change in potential causes electrons to break away from their parent atoms and fly alone through the metal. Under normal circumstances, however, this is not a smooth flight. The electrons are buffeted about by shock waves (phonons) caused by the vibrations of nearby atoms and are continually crashing into one another. These waves and crashes produce a *resistance* to the free and perpetual flow of electrons.

Classical theories of physics held that as conducting metals grew colder and colder, atomic vibration would slow down and resistance would decrease. At absolute zero, it was reasoned, resistance would disappear completely.

Early in this century, however, the Dutch scientist Heike Kamerlingh Onnes conducted experiments that contradicted one element of this picture. Several degrees above absolute zero, although the atoms were still vibrating, resistance disappeared anyway. It was found that only certain metals display this superconducting property and that the critical temperature (the temperature at which resistance disappears) is different for each metal. Part of BSC theory allows prediction of just which metals will be superconductors at these extremely low temperatures.

But resistance caused by atomic vibration is not the only interference electrons must contend with. They also are attracted by nearby atomic particles and thus slowed down or diverted in their path. Normally, atoms are neutral in charge, due to a balance of protons and electrons. But when atoms lose an electron—as they do when electrical flow begins—they become positively charged *ions*. Since oppositely charged particles attract, the free-flying negatively charged electrons are normally pulled toward the ions, resulting in a change in path or even a collision.

In superconductors, however, as the BSC theory explains, a special type of mating between electrons prevents them from being drawn off course by positive ions. In the BSC view, one electron pairs with a second electron somewhere in the conducting metal. These electrons have the same momentum and the same speed but *spin in opposite directions*. In the quantum world, the matching momentum dictates that electrons will fly toward each other (although they will never collide, since they have the same charge). The attraction between these electrons overcomes the attraction of nearby positive ions and permits the electrons to flow on virtually forever. □

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teacher. If so, Bardeen the teacher was often excruciatingly indirect. But then, so was Socrates.

"Bardeen would sometimes come into my office and ask how I was doing on the problem, that is, superconductivity," the boyish Schrieffer recalls of his graduate days in the 1950s. "I'd say I was having difficulties here and there, and he would say, 'Hmmm,' walk around a little, and leave. An hour later he might come back, write a couple of things on the blackboard, and leave again."

Bardeen lifted the edge of the blanket, Schrieffer remembers, but the student had to look underneath all by himself. He was the intellectual teaser who could draw students (admittedly already very bright students) to heights of independent creativity.

While Bardeen held the blanket, Cooper and Schrieffer looked under and saw the wonderful secrets of perpetual motion and levitation that resulted in the BCS theory . . . and the Prize. Schrieffer knew they had made the big score the day he took a radically different equation into Bardeen's office. He didn't know whether the equation was right or wrong, but he knew it was interesting. Bardeen looked at it for a couple of minutes, mumbled, trembled, then blurted:

"That's the right answer!"

The Swedes waited sixteen years to agree with Bardeen that BCS *was* the right answer, which is an interesting illustration of Nobel supercaution. Before it is accorded Nobel status, a theory must withstand long and harrowing tests of time. If there were a Nobel Prize in pop music, for example, Elvis Presley would only now be receiving it for "Hound Dog," and the Beatles would still be waiting.

Even after sixteen years, the physics prize judges hesitated before breaking Nobel precedent by giving the prize twice to one man. A number of imagination-shattering discoveries in astrophysics and cosmology were considered for the 1972 physics prize, as was a breakthrough in low-temperature physics by Cambridge University's young Brian Josephson. But the anti-Bardeen arguments tumbled one by one, as Bardeenists pointed out that Josephson's discoveries actually stemmed from the BCS theory. As for astrophysics, they contended, the elegant equations of BCS were general enough to explain the strange fluid motions of neutrons in neutron stars, as well as those of conventional neutrons in the average atomic nucleus. BCS may even explain some questions in molecular biology, such as the amazingly smooth flow of electrons along the chains of giant DNA and protein molecules. Finally, the Swedish Bardeenists won. BCS was ruled a profoundly general and useful landmark in several areas of basic science, as well as in technology.

If the Nobel judges waited a long time to recognize superconductivity, few others did. By the time of Bardeen's second Nobel coronation, extremely powerful magnets, small and efficient because their magnetic fields are produced by superconducting currents, were already in wide scientific use and were beginning to have an industrial impact. Several nations, including the United States, now are experimenting with applications of these magnets in transportation systems. In Japan, for example, a prototype now exists of a commuter train that uses the magnetic-repulsion feature of superconductors. By pairing strong magnets with magnetically repulsive superconducting metals, the trains actually "float," flying-carpet style, over their guideways.

> Colorful crackpots have sought the secrets of levitation and perpetual motion, but Bardeen was the first to uncover them.

Theoretically, such frictionless conditions would permit the trains to achieve speeds of more than 300 miles per hour.

Another outgrowth of the BCS theory is the development of scientific instruments that can sense very weak magnetic fields. Such devices have a number of potential applications, especially in medicine. These sensors could chart the almost imperceptible magnetic fields induced by blood flow in the human body. "Magneto-cardiograms" would permit comparison of the magnetic profile of the healthy body with that of the sick.

Still closer to reality is the construction of superconducting generators. Westinghouse recently announced the construction of a prototype of such a power generator that is expected to provide electrical needs for entire cities in the mid-1980s. A superconducting generator, the company maintains, could be ten times smaller than a contemporary generator producing the same amount of power and would cut resistance-induced losses of electricity by two-thirds. Less-powerful versions for ships and auxiliary power stations (such as those used in hospitals) are expected to be operating by the late 1970s.

The potential of superconductivity is enormous, but to the counts and barons of the Swedish elite, who care little for science, it was not enough to bring a physicist to their attention. The literary prize winner, in the eye of the Swedes, is the man to corner, and only the most charismatic of scientists can draw them away from their perennial target. And, unfortunately, Bardeen is not the type.

Yet if he could have told them about his current work and its twenty-first-century possibilities, they just might have been a bit more impressed.

Back in Champaign-Urbana, the Illinois prairie town dominated by Bardeen's university, a bright, small-featured, cheerful fellow named Jim Bray is giving a lunchtime lecture to his fellow graduate students in physics. Bray's sharpness obviously establishes him as a Bardeen student—John always gets the best, thanks to his Nobel reputation and to the network of the physics culture.

Bray puts equations on the blackboard, while the other students eat their brown-bag sandwiches. He refers to tentative experiments in metallurgy involving a union between the metals niobium and titanium, plus the addition of one very thin metallic layer. He makes a reference to having checked the "Soviet literature" to see what the Russians are doing in Bray's own research area. John Bardeen, a member of the audience, points to an equation on the blackboard and remarks that he doubts the Soviets have anything like that.

The discussion is about something that Bardeen regards as a 100-to-1 shot. Bray, like Cooper and Schrieffer before him, is a graduate student working on a problem that interests him, of course, but that also is of primary interest to Bardeen. Even if the attempt fails, as Bardeen thinks it might, Bray will be assured of a bright career now that he has worked with the Socrates-Edison of Champaign-Urbana.

Bray is talking about a *room-temperature* superconductor.

At the moment it takes a bit of doing to milk superconductivity of its technological advantages. Just reaching the near–absolute zero transition temperatures requires large investments in extremely expensive refrigerating equipment. Supercool is costly, and even if it made endless amounts of electrical power cheaply available, the transition of current through supercool underground pipes would require many closely spaced refrigeration stations along the way.

But at *room temperature*, the BCS perpetual motion–levitation machine, the eternally balanced and flowing river of energy, could perhaps fuel this planet forever, bringing economic and political revolutions in its wake.

If the 100-to-1 shot *is* achieved, it is possible that John Bardeen will return once again to Stockholm for the third Nobel endorsement. Then, perhaps, he will no longer be overlooked. □

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BY ROGER RAPOPORT

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Jerry Neal Schneider, president of the firm described in the ad above, is a handsome, twenty-one-year-old engineering graduate of UCLA who has just entered the burgeoning security business. Despite his age, Jerry has a considerable head start on his competition —he already understands the increasing vulnerability of government complexes, office towers, universities, factories, shopping centers, and banks better than most veteran security experts. He should. He is currently on probation for stealing about $1 million worth of phone equipment from Pacific Telephone Company over the past three years.

All his thefts were made by cracking the phone company's computerized ordering system. Getting phone equipment for free, Jerry then illegally resold it to private customers through his own firm, the Los Angeles Telephone and Telegraph Company. He easily undercut the price of his unknowing equipment supplier and only competitor, Pacific Telephone. Besides paying his way through UCLA, the scheme netted Jerry about $250,000—enough to drive a Continental and reside comfortably in the Malibu Hills.

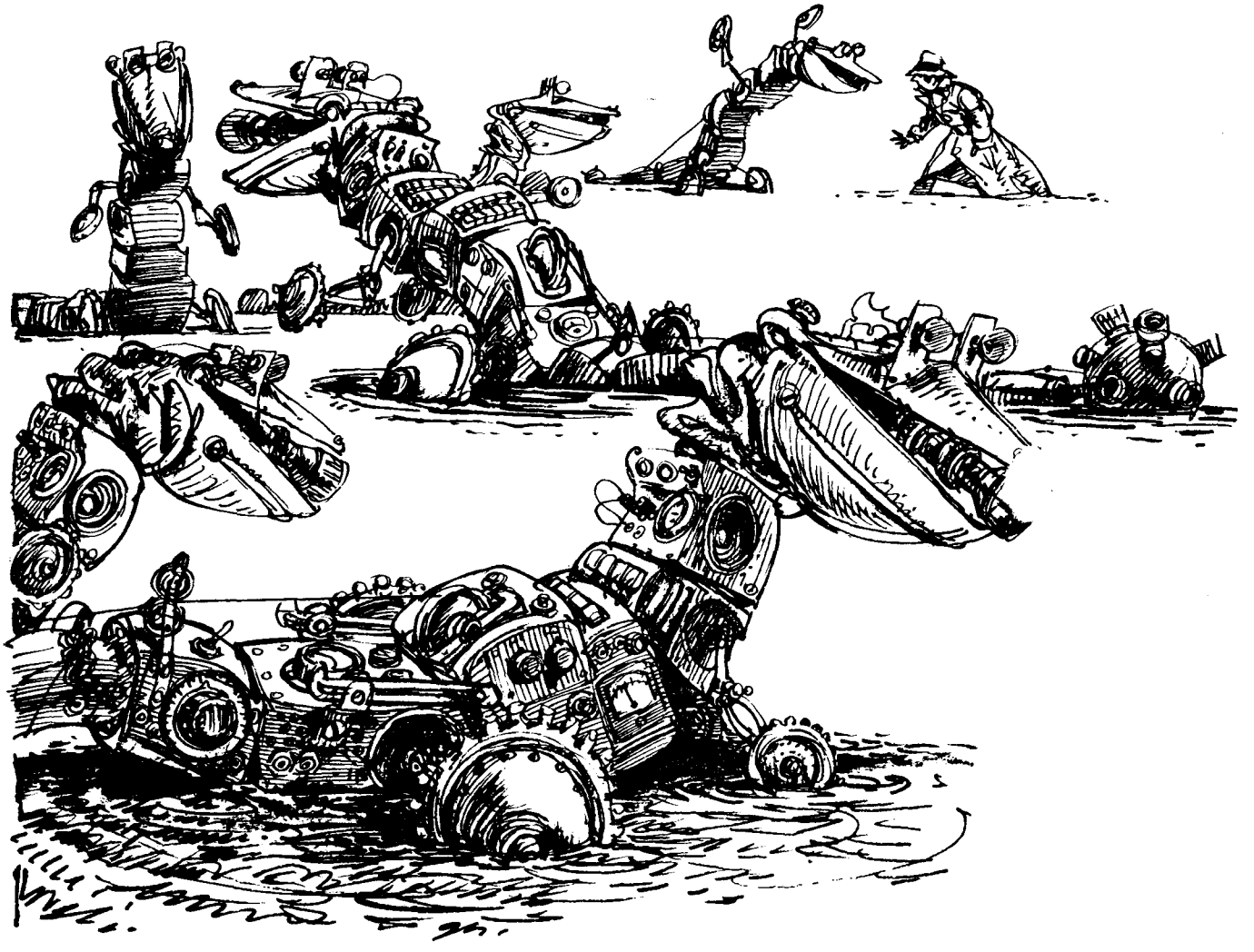
He probably could have continued bilking the phone company indefinitely, were it not for a disgruntled employee who turned him in to the police after Schneider had spurned his demands for a dollar-an-hour wage hike. ("That was extortion," says Jerry, "and I wasn't going to have any part of it.")

Following his arrest in February 1972, Jerry was fined $500 for grand theft and sentenced to forty days at a county work camp just a mile from his Malibu home. Once released, he decided to go straight and invest his LAT&T profits in his new security company: "After all, no one is going to know more about protecting a computer than a guy who's cracked one."

The notion of a paroled criminal advising companies how to protect themselves may seem audacious. However, in the mysterious world of institutional security, the relationship between cops

Roger Rapoport is a freelance writer based in El Cerrito, California.

Today's institutional fortress is guarded by space age gadgetry, but the cunning criminal can still find a way to bridge the moat.



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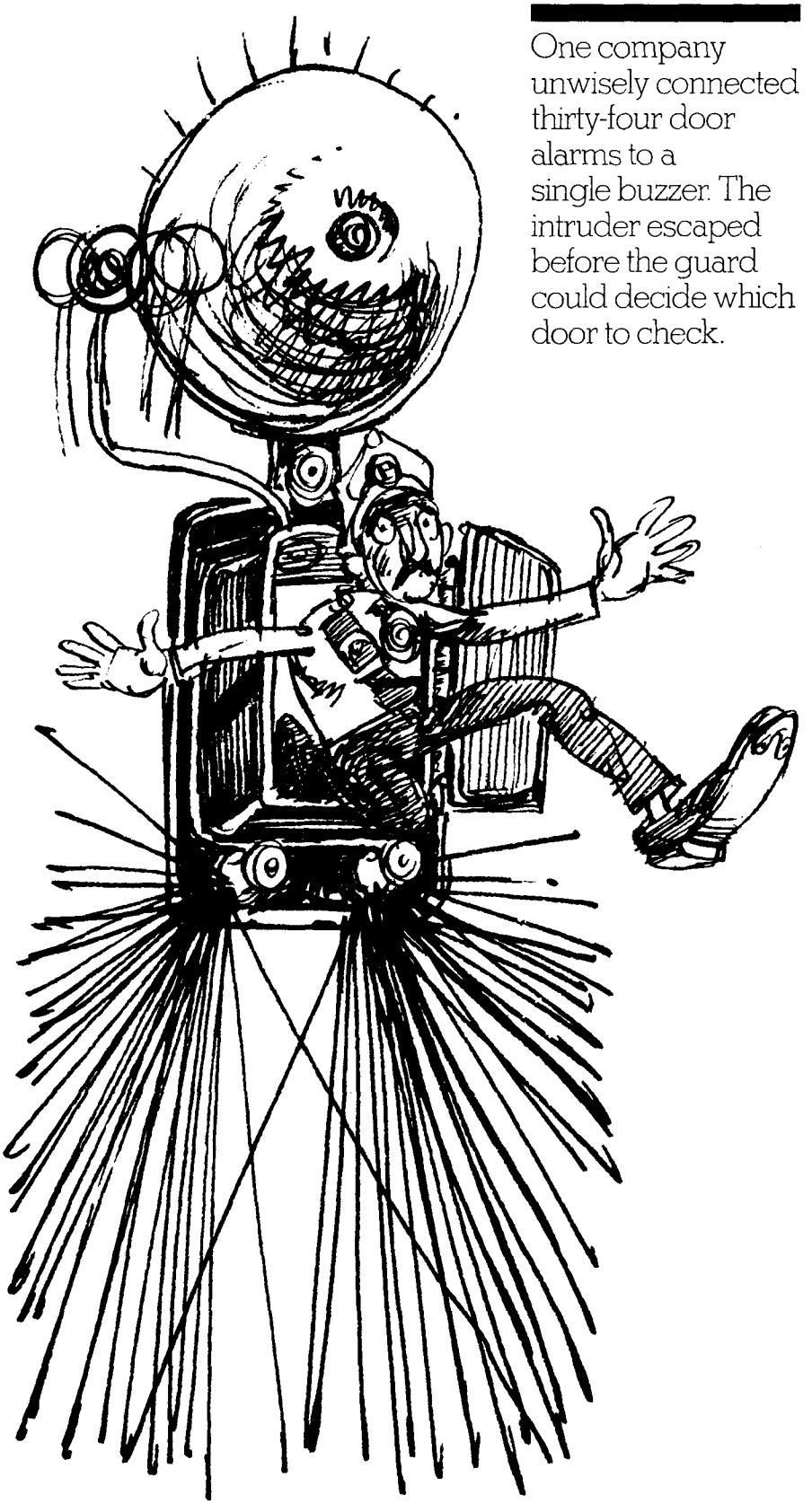

One company unwisely connected thirty-four door alarms to a single buzzer. The intruder escaped before the guard could decide which door to check.

ILLUSTRATIONS BY GENE HOLTAN

and robbers often is closer than you think. Security experts frequently imagine themselves in the role of the potential criminal. To pinpoint defects, some actually simulate the crime by trying to break through alarm systems that they themselves designed.

In the increasingly sophisticated security world, devices created by physicists, chemists, engineers, acousticians, seismologists, and computer experts have replaced yesterday's armed guard. Thanks to their efforts, airports now have closed circuit television cameras that can spot prowlers two miles away in the dark. Many factories now use electronic card-key access systems; employees of RCA in Zurich, Switzerland, use holographic cards to gain entrance to the company's new technical center. Boundaries of government installations are protected by ultrasonic, infrared, seismic, photoelectric, microwave, magnetic, and motion-detection systems. Universities employ acoustic listening devices that eavesdrop on intruders. Museums enjoy the advantages of vibration detectors and instant-replay cameras that will catch unauthorized movement of priceless works of art.

Many of these detection devices are centralized in automated security computers sufficiently versatile to protect buildings a thousand miles away. Those guards who have not been automated out of a job work under the direction of security computers that check up on them electronically.

The proliferation of these Buck Rogers devices is technology's answer to a crime wave that has outdistanced conventional security systems. During the past decade America's crime rate has increased by 142 per cent. A new generation of urban guerrillas plagues multinational corporations, courthouses, airlines, museums, embassies, even the Olympics. Centralization of society's vital services in giant computer centers, reservoirs, nuclear power plants, air-traffic control centers, 100-story skyscrapers, and government compounds increases its vulnerability. By carefully choosing his targets, today's saboteur could pollute a city's water supply, dynamite power transmission towers, cripple an airport control center, destroy a corporate or government computer center.

To outsmart the cunning criminal, the institutional security specialist must guard even against the crimes that have never happened. Planning a computer center, for example, depends heavily on the security consultant's estimate of where and how thieves or saboteurs *might* strike. In fact, some corporations won't even consider new plans for such projects as tertiary sewage plants unless they come with a designed-in security package.

These are some of the reasons why

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the nation's security expenditures, $4.1 billion this year, are expected to soar more than 30 per cent over the next three years, to a staggering $5.9 billion annually. At their most sophisticated level, these new devices are integrated into package systems in which alarms, closed circuit TV, access-control systems, intercoms, critical equipment monitors, and response systems came together in a central security computer overseen by a single operator.

The Ampex Corporation, for example, centralizes security for nine different plants spread across California and New Mexico in a single Honeywell computer at its Redwood City, California, headquarters. A similar system guards Chicago's $95 million convention center, McCormack Place. This computer locks and unlocks doors at appropriate times, watches for vandalism, and prints out alarms on a teletype. During emergencies a display unit projects floor plans of affected areas to facilitate police response.

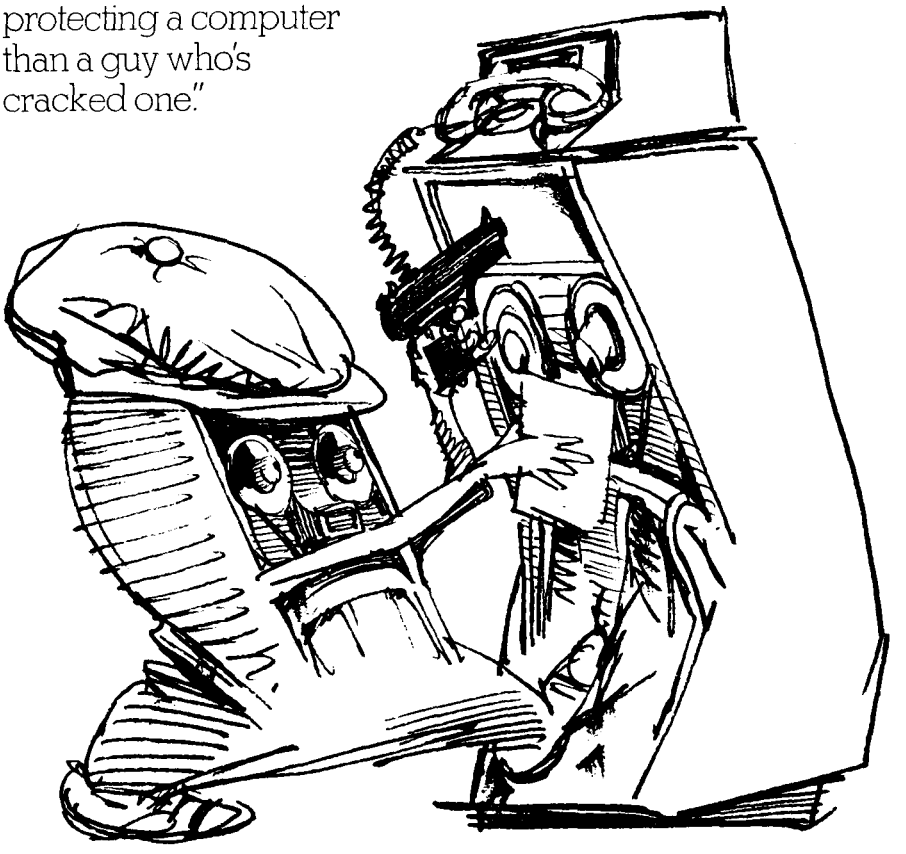
The system also keeps an eye on guards, who must periodically check in with the computer by turning switches along their patrol route. In addition, the McCormack unit transmits false alarms every ten to twenty-five minutes to make certain the operator hasn't slipped out of the control room for a hamburger. According to William Brasch, who oversees the entire McCormack Place system, "If an operator doesn't acknowledge an alarm within three minutes, he can kiss his job good-bye. It's not like big brother or anything; it's just our way of making sure our men are doing their job."

The computer also has accessory functions that include regulating the McCormack Place heating and ventilating system. A special link even connects the central unit with an infrared counter device in each of the center's fifty-eight bathrooms. "After 250 women or 500 men enter one of our restrooms, a signal goes to the computer center, where our men notify housekeeping it's time for a cleanup," says Brasch. "Frankly, I question the value of this system and its implication that men are somehow neater than women. I sure hope women's liberation doesn't find out about it."

Actually, bathroom security is no joke to many institutions. Visitors to classified sectors of Atomic Energy Commission installations or the Lockheed Missiles and Space Company must be accompanied to the bathroom by an escort. Security analysts with the new Bay Area Rapid Transit System decided that the best way of stopping bathroom muggings was to tailor bathrooms just big enough for one occupant at a time.

Many new security systems stress two-way capability. At Bay State West, a $57 million shopping-office-hotel complex in Springfield, Massachusetts, a network of closed circuit television units works on the candid camera principle. When a security agent notices trouble on one of his closed circuit monitors, he speaks directly to the offender through a speaker mounted in the camera. "It scares hell out of them," remarked Bay State West security director, Gary Crosen. "Usually we get a positive response, but sometimes younger kids will give us the finger."

"After all, no one is going to know more about protecting a computer than a guy who's cracked one."



Other new two-way systems effectively deputize the average citizen. The parking garage at Crown Center, a $200 million residential-business center being constructed in Kansas City, has thirty-five intercom stations where customers can report suspicious doings. This center also has equipped its fifteen office elevators with audio detection systems that listen for unusually loud sounds. When the decibel level exceeds a predetermined level, the system snaps on and transmits the audio play-by-play to headquarters.

Although this device is severely limited in situations where quiet criminals subdue their victims quickly, it does have some hidden benefits. An audio detection unit at Wayne State University recently saved a young woman from a rapist. Assaulted late one night, she struggled to an office building and pounded on the door for help. Although no one was inside, her banging made enough noise to activate an audio detection device. "When our speaker came on, all we could hear was a muffled thrashing noise. We rushed in to check it out and managed to arrest the guy," said Wayne State police captain Dallas Schneider.

Wayne, with 37,000 students on its inner-city campus, is one of the nation's most tightly secured universities. At no point on campus is a student more than 100 yards from one of ninety-five police "hot-line" phones, each topped with mercury vapor lights that cast eerie blue shadows each night.

Some secondary school systems are moving students into new windowless buildings with closed circuit TV, card-key access systems, and electric door alarms linked to a district security center. Seattle recently tied thirty schools into a central system. Honeywell has begun rewiring high school public address systems into audio detection units.

The nation's Capitol building is also tightening up security, thanks to a $3 million appropriation from Congress. The money will go for closed circuit

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TV, intrusion devices, package X-ray machines, and a new control room. Over at the National Archives our Constitution, Bill of Rights, and Declaration of Independence are lowered into an eighty-foot vault each night for safekeeping.

Federal courts, a favorite with bombers in recent years, are being hardened considerably. In San Diego, microphones have been installed in the walls of courthouse corridors so that security dispatchers can eavesdrop on conversations. Many judges now have "panic buttons" next to their gavels for summoning police. These buttons switch on courtroom microphones for the security dispatcher's benefit. He can then consult his closed circuit TV monitor for a look at the trouble.

One problem with closed circuit TV is that the guard often must study numerous screens at the same time. Crimes can be committed before he gets a good look at the criminal. Western Bureau of Investigation solved this problem with its new total surveillance system. Clarence Boice, inventor of "instant replay," devised a camera for WBI that immediately begins recording when any changes occur within its field of vision. The guard can punch an instant replay of the crime, and a related computer console recommends the appropriate emergency response over teletype. This system has already been installed in a new Los Angeles American Broadcasting Company Entertainment Center and will soon be added to the presidential palace in Guatemala.

Many new institutions are supplementing their security computers with careful psychological planning. To handle everything from poachers in the game preserve to mad bombers in Frontierland, Florida's new Disney World employs a sizable security force designed not to intimidate the thousands of daily visitors. Instead of regular cops, the Disney empire deploys "security hosts" clad in blue shirts, dark blue trousers, ascots, white spats, and black shoes. In theme sections guards wear special uniforms: marshals for Frontierland, Keystone Kops for Main Street, and western frontier guards in the hotel and campground areas.

Although Disney World's computerized security system is capable of monitoring 25,000 points simultaneously, it pales when compared with protection surrounding classified government jobs. Stanford Research Institute, for example, has developed special procedures for protecting its top-secret projects. The highly sophisticated computer room at SRI is surrounded by a steel-plate shell. Otherwise spies could park a truck nearby, pick up radio waves from the computer's electromagnetic systems, and convert them into usable form. As added protection against electronic eavesdropping, other computers in the room are switched on to mask radio waves from the top-secret unit. Programmers conceal secret government or industrial work by using new tapes and teletype ribbons for each job, as well as by carefully erasing confidential information from the computer's memory unit. This eliminates any chance of spies picking up residual project information in the computer.

Even tighter security surrounds such espionage-prone industries as the toy business, where theft of a new product idea can destroy an entire marketing season. This is why one Los Angeles toy manufacturer conducts all classified discussions in a bugproof room surrounded by eight inches of acoustic material. Static noise generators serve as further insurance against eavesdropping.

Sophisticated as all these systems are, none can be considered foolproof. More security does not always mean better security, and things can always go wrong. Morris Fealy, vice-president of Advanced Devices Laboratories, the nation's leading manufacturer of infra-

Visitors to classified Atomic Energy Commission installations must be accompanied to the bathroom by an escort.

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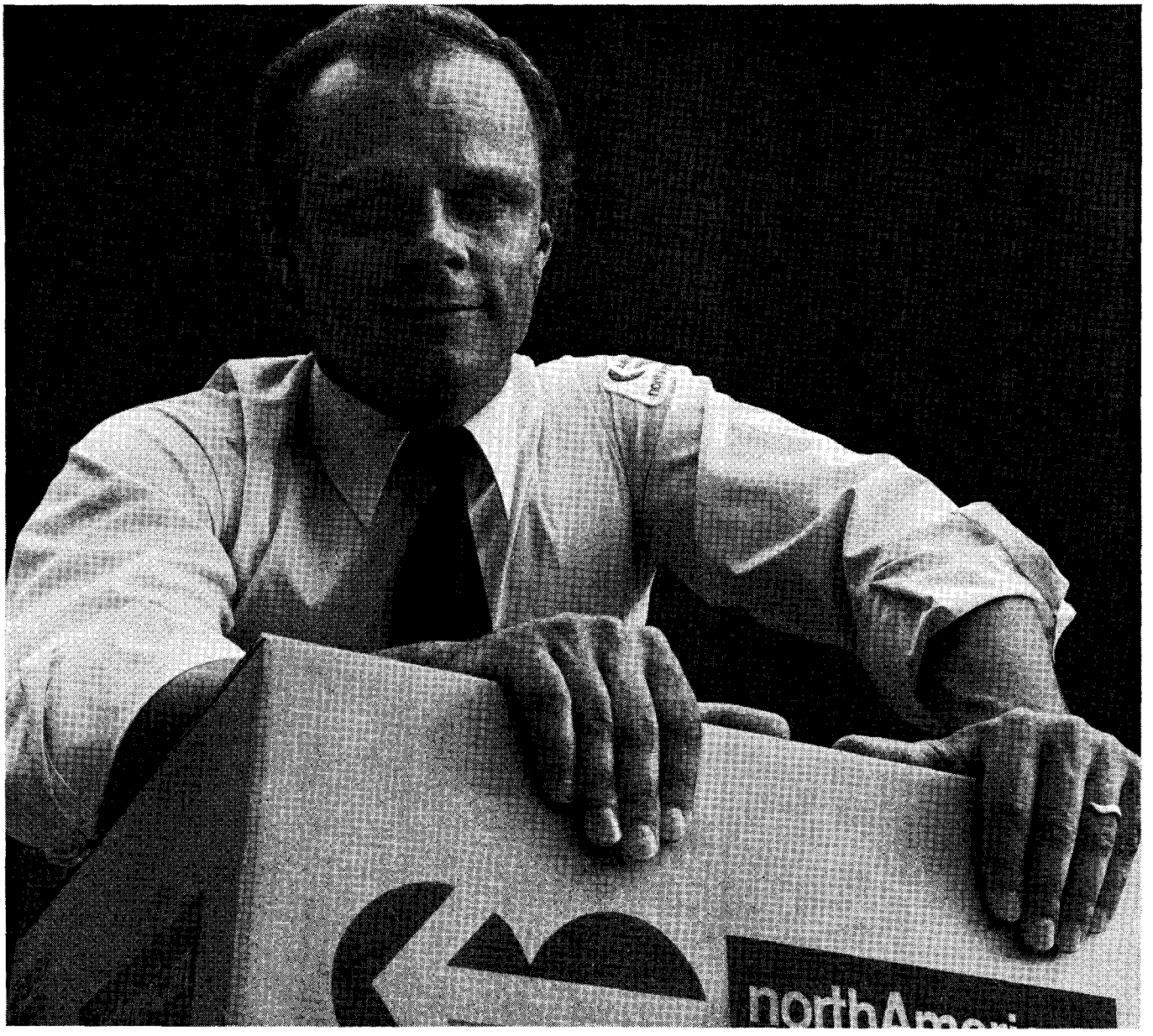

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Tight security surrounds industries like the toy business, where the theft of a new product idea can destroy an entire marketing season.

red security systems for government and industry, has no alarms in his own home ("when I go to Europe," he says, "I just hire a housesitter") and notes that even the devices protecting his Santa Clara, California, plant have turned in false alarms. "One Saturday I came in to catch up on some work; just as I was leaving, the police rushed in. I'd accidentally tripped our own system—forgot the damn thing was on."

The proliferation of security units has actually slowed police response time in some areas. The problem, according to Dayton security consultant S. J. Curtis, is that "between 94 and 98 per cent of alarms from all systems are false, due to bad equipment." In Los Angeles, where nineteen out of twenty alarms are false, police have given them a lower response priority. They became tired of rushing to the scene only to find that a prowling cat had actuated the system. False alarms have persuaded some cities to ban hookup of alarms to telephone dialers that automatically call police. A number of communities are even threatening to cut off police response to facilities that repeatedly send in false alarms.

Some problems with these advanced devices relate to design oversights. Many exclusive subdivisions are installing defensive systems that include even coded identification tags for dogs. But shortly after a $32,000 network was put into a Las Vegas subdivision, thieves foiled the alarms and made a big heist. It turned out that the manufacturer had protected the system control box with an 89-cent lock, which could be picked by any of 200,000 keys. Furthermore, employees sometimes discover simple ways to beat sophisticated surveillance systems. Workmen at a Chicago liquor warehouse recently blocked a microwave unit by stacking boxes in front of its coverage pattern, leaving an unsecured shadow where they could slip out cases of booze.

Industry's most serious security problem, however, is poor planning and misuse of modern systems. Honeywell's chief security engineer, Eugene Fuss, estimates that one-third of all American corporate money spent on protective systems is virtually wasted. He points to one company that blindly connected thirty-four door alarms to a single buzzer at the guard desk. When the alarm went off, he had to check all thirty-four doors, and the intruder naturally escaped.

New systems are often used beyond their capabilities. Over a year ago Los Angeles security consultant Don Darling slipped through a magnetometer, an airline antihijacking device, with an aluminum thirty-eight, a stainless-steel buck knife, brass knuckles, and a can of Mace (the device could not detect nonferrous metals). Luckily, technological advancements in metal detection prevent him from doing so now. Progress in inspecting luggage with portable, quick-scanning X-ray equipment also has been made (that undeveloped roll of family vacation pictures is no longer in danger).

Unfortunately, even the best security setups can be vulnerable. The Pentagon's Defense Nuclear Agency has always been proud of protection surrounding its Manzano base, outside Albuquerque, New Mexico. Thousands of retired nuclear weapons are stockpiled behind four heavily alarmed fences and watched by scores of guards. But in January 1971 two young Mexicans actually cracked Manzano's security system. When the Mexicans were apprehended inside the base, the military immediately brought in a Spanish translator to ask the young men how they had managed to beat the alarms, electrified fences, and barbed wire. The trespassers indicated that they thought Manzano was a rich ranch where they could get food and work. Both were deported, but Manzano officials refused to explain how the Mexicans broke inside America's largest nuclear garrison. They explained that reporting details of the trespass would illegally reveal classified security procedures.

Perhaps the toughest job of all is faced by computer protection consultants. Donn Parker, a computer security analyst at Stanford Research Institute, finds that "a lot of today's crimes become obsolete as processes are taken over by computers. As we move toward electronic bookkeeping and the cashless, checkless society, computer protection becomes increasingly important." Hon-

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eywell actually estimates that crippling 100 key computers would paralyze American business.

A survey by SRI's Parker has produced more than 100 reported acts of computer-related crime in recent years. Serious incidents of computer sabotage ranged from fire bombing of a Fresno State College computer during a student riot ($1 million damage) to the destruction of magnetic tapes and punch cards at a Dow Chemical computer center by the members of an antiwar group.

Some crimes were possible only within the computer industry itself, like the theft involving a programmer from Palo Alto–based University Computing Company (UCC). By dialing a special access code, he was able to get a full printout of a program used by a competitor, Information Systems Design (ISD) of Oakland. ISD had been using this program on a job with Aerojet General. After the theft was discovered, ISD filed a suit charging that UCC stole the contract to develop computer capability that could help them win away the Aerojet contract. The jury awarded ISD $300,000 damages.

Although these outside incidents aroused considerable concern, most companies with computers are primarily worried about the cases of theft and sabotage from within their own ranks. In Dallas a computer technician took home $5 million worth of programs and tried to sell them to another company. In Pittsburgh a bank computer programmer quietly deposited $200,000 into his own account. In Chicago, *Encyclopedia Britannica* employees tried to peddle computerized mailing lists. Fortunately, all these crooks were caught.

Deliberate attempts by employees to foul up their company's computers are difficult to prevent. Three disgruntled computer technicians once sent signals by telephone that activated the data collection systems in Metropolitan Life Insurance's field offices, causing paper tapes to spew from the machines. Another insurance company, National Farmers' Union Service Corporation in Denver, recently unraveled a computer mystery that had plagued them for two years. During that time their computer's storage unit burned out fifty-six different times, causing the entire system to shut down. Technical experts spent approximately $500,000 in attempts to correct the problem, eliminating everything except human intervention. Finally, a closed circuit TV camera recorded an employee tampering with the computer. The man pleaded guilty to "malicious mischief," explaining that he had an uncontrollable urge to shut the machine down.

The best security system in the world will never be completely people-proof, admits consultant Don Darling. "What it comes down to," he says, "is that there are no final solutions in the security business. The practicing scientists and engineers are not even reducing crime. We're just filling up the moat with electronic alligators. All this does is allow us to harden up the affluent parts of society and divert crime to less affluent parts, until America can make the necessary social changes."

But even as Darling speaks, scientists in countless laboratories are working overtime on new and better alligators that they think just might solve the extant problems of the security business. In Japan researchers are developing lip-print identification systems. Spin-off from military technology developed for Vietnam is expected, say security specialists, particularly people-detecting sensors. One new sensory research area involves detection of the stress signals given off by individuals in extreme states of fear. To help reduce the excessive false alarm rate, field tests are underway on special dual-alarm systems, in which two unlike sensors—such as ultrasonic and infrared, for example—must be triggered before an alarm actually sounds.

In Bozeman, Montana, an electrical engineering professor is trying to thwart cattle rustling by feeding tiny radio transmitters to three-hour-old calves. The transmitter lodges in the animal's stomach and sends out a special code that pinpoints his location for a rancher. "In effect each animal has his own social security number," says Dr. John Hanton, the Montana State University professor who invented the system. And perhaps the most broad-ranging idea of all comes from the Palo Alto laboratories of Basic Computing Arts. This firm's president, Dr. Jerry Kennedy, is working on a small, battery-powered transponder that could be surgically implanted in the human body like a pacemaker:

"The electronic bug would send out a signal that uniquely identifies you to a receiver unit. It's like having an electronic password. You could use it for admission to classified areas, confirmation of your identity for credit card use, or even unlocking your own car's ignition. The possibilities are really limitless. This device could be embedded anywhere on the body or even put inside a false tooth. Of course, there's always the possibility that some enemy agent might try to cut you open and get your unit. I guess that might cause some market resistance. Perhaps we're a little ahead of our time. But I think the country will be ready for it in two or three years." □

Surgically implanting electronic units in the human body is a futuristic means of identifying people.

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Conscription at Sea

BY BRUCE WALLACE

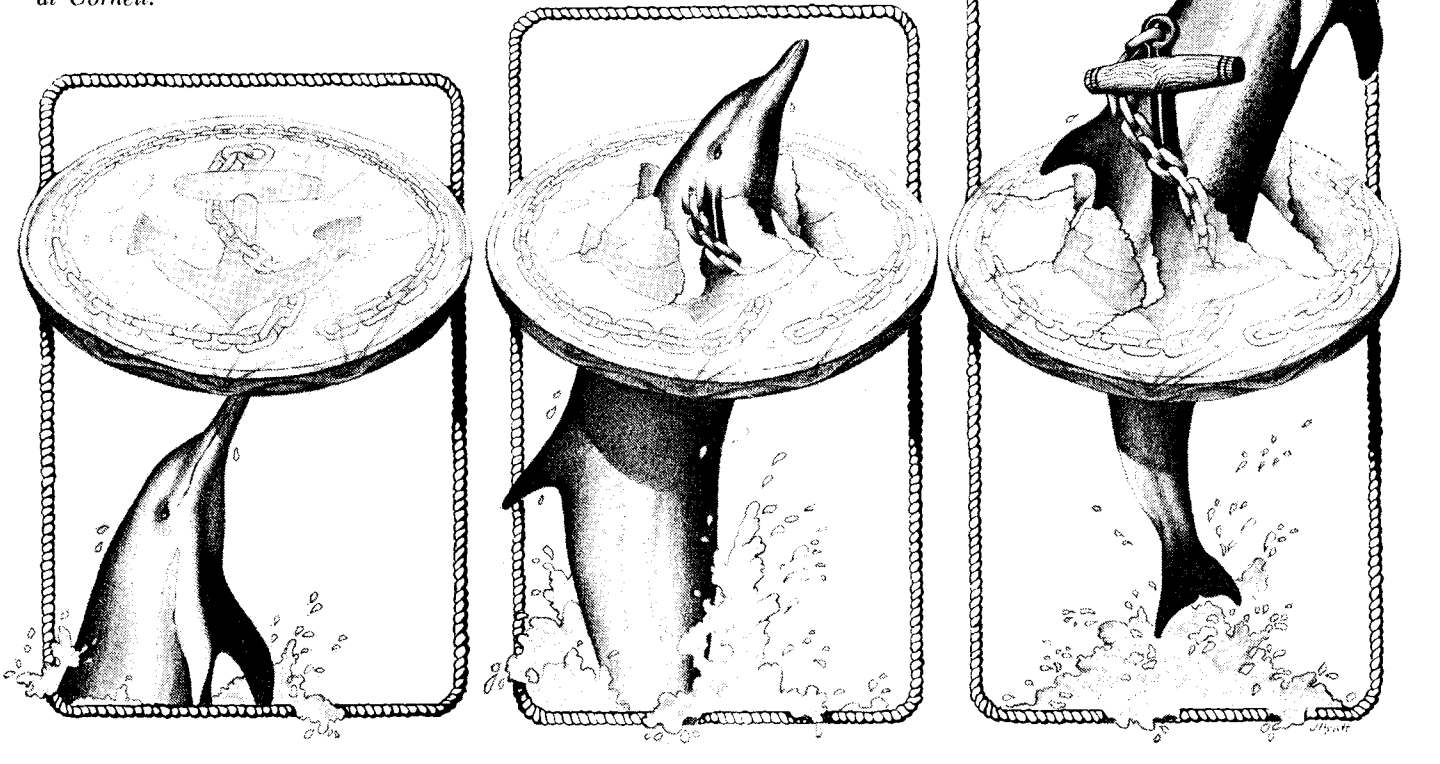
THE RECENT ABOLITION OF THE DRAFT SADLY DOES NOT EXTEND TO WHALES, PORPOISES, AND SEA LIONS.

War and preparations for war are infected by the macabre. Professional satirists recognize this and exploit it. No sooner had the Strategic Arms Limitation Treaty discussions ended than Art Buchwald, tongue in cheek, described what a boon this treaty would be to munitions makers and armament suppliers. Boon? Yes, indeed, because all of the arms not prohibited by the treaty now would have to be invented and/or perfected. Less than two weeks after the publication of Buchwald's cynical article, the then secretary of defense, Melvin Laird, appeared before a congressional committee to argue precisely that point. The arms-limitation treaty, rather than inviting a reduction in defense spending, called for an increase, because new items not covered by the treaty were now in need of research and development. Satire preceded reality by a dozen days or so.

That tragic events can hinge on logic such as this was illustrated by the late physicist Leo Szilard in his short story "The Voice of the Dolphins." In Szilard's fictional account, the Soviet Union and the United States are confronting one another over Middle Eastern oil. Russia, to show that her demands must be met, has submitted a list of twelve American cities that are to be destroyed one by one; to avoid unnecessary bloodshed, however, an advance warning is to be given so that inhabitants can be safely evacuated before the destruction of each city. In reply, the United States threatens to annihilate two Russian cities for every American one destroyed.

"To this," Szilard's story continues, "Russia replied in a second note—a note of unprecedented length—that if America were to demolish two cities in Russia for each city that Russia might have demolished in America, and if Russia were to demolish two cities in America for each city America might have demolished in Russia, then the destruction of even one city would trigger

Bruce Wallace is a professor of genetics at Cornell.



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a chain of events which would, step by step, lead to the destruction of all American as well as all Russian cities. Since clearly America could not possibly want this result, she should not make such a threat of 'two for one' and expect it to be believed."

There is, as the Russian message implied, a predictability to warfare: events, once started, leapfrog in a seemingly preordained pattern. Consequently—and now I come to the point of my story—when the navy utilizes marine mammals as serious military allies, one can predict with considerable accuracy the course of subsequent events. Sea lions, pilot whales, porpoises, and killer whales are all being trained for various tasks by the Marine Life Sciences Laboratory, a division of the Naval Undersea Center in San Diego.

Consider the use of armed porpoises trained as guards against enemy frogmen. Upon spotting a frogman, the porpoise sends a signal to a sailor in a nearby monitoring vessel. Should no friendly frogmen be authorized in the vicinity, the sailor radios back, "Kill!" The porpoise then drives the knife that is strapped to its snout into the enemy frogman. Porpoises trained in this way were used not long ago in and around Haiphong Harbor. It is not difficult to imagine an explosive device in place of the knife. Unwittingly, the porpoise then becomes a sacrificial mine. Another project that has been reported involves whales. Wearing special harnesses, they have been trained to recover objects (torpedoes, for example) that have been lost at sea.

Judging by the few published accounts, Operation Porpoise and Operation Whale (my own terms for these classified projects) have been successful, not because porpoises and whales share the American political ideal, but because they can be trained under an appropriate system of punishments and rewards. What Americans have done, then, we must expect our enemies to do also, or so goes the premise upon which war logic is based. And if an enemy were to train porpoises for wartime duties, what should our defenses against them be? And how are we to know an enemy porpoise from one of our own or an innocent byswimmer?

We can assume that panels of learned men have already been assembled to ponder these questions. We can assume, too, that their charge as a committee was to recommend a short-run solution. They will have been asked about the feasibility of destroying porpoises and whales throughout tens of thousands of square miles of the sea, throughout a theater of operations. Just as their colleagues from the Forestry Service were consulted about the defoliation of Vietnamese jungle, and just as their colleagues from the Meteorological Service were consulted about rainmaking for military purposes, so will animal physiologists and marine ecologists be asked to plot the wholesale destruction of porpoises and whales. Is there, for example, a poison that might be spread on the surface of the sea that would be effective in killing porpoises as they surface to breathe?

One is relatively safe in predicting that panels have begun discussing the practicability of wiping out porpoises and whales, because to fail to do so would demonstrate gross incompetence on the part of our strategists. For every weapon there must be a counter-weapon; for every strategy, a counter-strategy. Hence, by the peculiar logic of war, plans must have been laid for the destruction of our new seagoing allies.

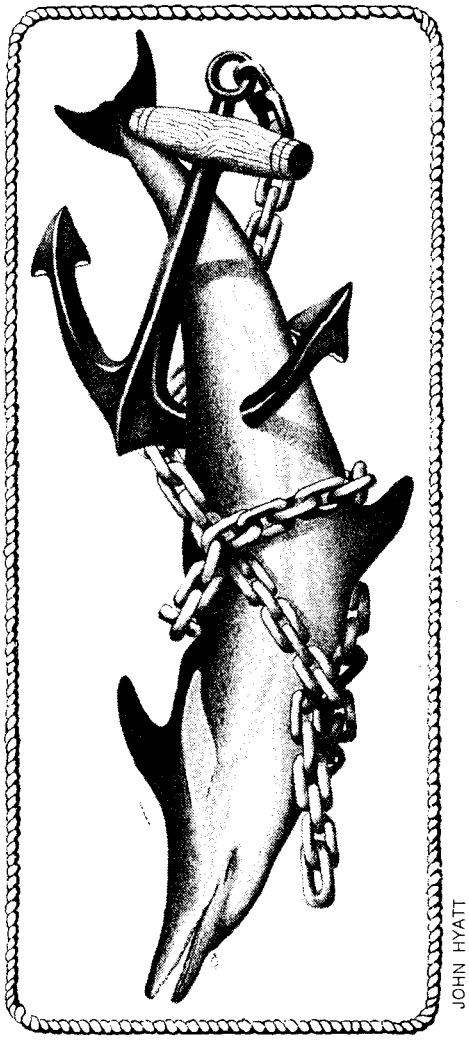
In the past, animals used in warfare shared two similarities: they were domesticated, which means that there were enough back home to replenish their fallen counterparts; and they were, by and large, clearly identifiable. It was the charging steed. Or the police dog leaping from one shell hole to the next. Or the homing pigeon carrying secret messages back to headquarters. All the enemy soldier had to do was fire away in hopes of bringing one or the other down.

Whales and porpoises, though, have few benefactors, and nobody at the moment is breeding them with any commercial intent. Also, they live in a natural environment, not on a battlefield; consequently, the enemy is unable to distinguish trained from untrained animals. Furthermore, these particular carnivorous predators occupy the top echelon in the marine community. The whole system beneath them depends on their continued existence. Their wholesale destruction could have ramifications far beyond the imagination—or concern—of most admirals. As on the land, where the diversity of plant life depends on the presence of certain herbivorous mammals and the diversity of these mammals depends in turn upon their predators, so the situation might be in the oceans. What, however, corresponds to a meadow in the marine community? Would the elimination of porpoises have consequences that would affect the composition of marine plankton? We are not sure how delicate the balance is or how easily it could be upset. However, assurances that there is no need for concern are as worthless as they are expectable.

How can a nation escape from the dilemma of using marine animals for allies and then, in fear that they may be used by others, of destroying ocean communities? One might extend the notion of bacteriological warfare, which has already been "outlawed," to include biological warfare of all kinds.

As a matter of practical importance, I would suggest prohibiting the use, for military or other aggressive purposes, of undomesticated animals, as well as animals that cannot be easily recognized as belonging to "the enemy" or to "the wild."

Such matters need prior thought; they cannot be resolved once events have been set in motion. Too many search-and-destroy missions have destroyed all human beings because a few were suspected of being legitimate targets. Too many saturation-bombing missions have been flown because pinpoint missions were difficult or impossible. Too many people have been identified as the enemy only because they were already dead. If large-scale destruction of human beings is accepted in warfare, how can the wholesale destruction of marine life be avoided except by not involving their members in mankind's problem? The steps to declare wild species off-limits should be taken now; otherwise they will not escape the macabre logic of war. □



JOHN HYATT

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THE LONGEVITY SEEKERS

SCIENTISTS FROM MANY DISCIPLINES HAVE JOINED THE FIGHT AGAINST AGING, RAISING NEW HOPES FOR A GENUINE FOUNTAIN OF YOUTH.

BY ALBERT ROSENFELD

We have always accepted old age, with all its attendant miseries, as the inevitable end of human life. Now, however, gerontologists are beginning to question its inevitability. As their researches gradually reveal to them the mechanisms of the aging process, they grow increasingly hopeful that they may one day be able, not merely to hold back the physical ravages of senescence, an outcome most of us would happily settle for, but to abolish altogether "old age" as we have known it.

There is good reason for their optimism. Consider a recent experiment, one of many hundreds in progress in laboratories around the world:

In a surgical technique called parabiosis, an aging rat is hooked up to a young rat so that they share a common blood circulation, like Siamese twins. They are joined tail-to-shoulder, which leaves them fairly free to move around. For the aging rat, parabiosis acts as a youth transfusion. In studies with more than 500 parabiotic rats, Frederic C. Ludwig of the University of California, Irvine, has found that his older subjects live significantly beyond their expected life-span. Something in the blood of the younger rats enabled the older rats to live long after all their unhooked-up littermates were dead. "When rats are joined parabiotically," says Zdanek Hruza of New York University, "remarkable biochemical changes take place." The older rats' cholesterol levels, for instance, go down "almost miraculously."

Some years ago, at NIH's Gerontology Research Center in Baltimore, Dietrich Bodenstein used parabiosis to create Siamese-twin cockroaches—again, young joined to old. Young cockroaches can regenerate lost limbs, but old roaches lose this capacity. In parabiotic combination the old roach recovered its regenerative powers. When Dr. Bodenstein lopped off a limb, it was promptly regrown. This renewal was attributed to the transference of juvenile hormone from the young roach to his Siamese twin. Could something similar be happening to the rats? Dr. Hruza says that if a hormone is involved, it's not any of the known hormones. What, then, is the nature of the "youth factor" (or factors) circulating in the blood of a young rat? Could it (or they) be isolated and used to prolong life without the need for parabiosis? And could the same be done for people?

Whatever the specific biochemistry involved, these cases clearly demonstrate that at least some characteristics of old age, formerly considered inevitable, *can* be held off, as in the case of the rats, or reversed, as in that of the cockroaches.

It has been known since 1917 that reducing body temperature slows the aging process. "In cold-blooded animals," says Bernard L. Strehler of the University of Southern California, "a tenfold increase in longevity has been achieved by lowering body temperature, without adversely affecting body function." Cooling slows things down in warm-blooded animals, too, though not so spectacularly. Recently Robert Meyers of Purdue cooled monkeys a few degrees by direct manipulation of the "thermostat" in the brain and thereby increased their life-span. It has been seriously suggested that people might one day sleep in cooled bedrooms or in slightly chilled waterbeds to achieve longer life.

Dr. Strehler knows of no exception to the rule that animals live longer at lower body temperatures and wonders whether long-lived people might not actually have slightly lower-than-average temperatures. "A very minor reduction in temperature, about three degrees Fahrenheit, could well add as much as thirty years to human life," Strehler says, "assuming, of course, that the human organism operates like its relatives in other species. There is no way to predict the long-term side effects of artificially reduced temperature, but drugs already exist that can reduce temperature by the requisite amount, and others will certainly be discovered."

Techniques such as cooling and parabiosis are comparatively gross methods of combating old age, but they may serve a useful interim purpose while we await further news from the frontiers of molecular biology. Dr. Strehler, a pioneer researcher on these frontiers, typifies the vigorous new breed of gerontologists—those who study the aging process itself, as distinguished from geriatricians, who study and treat the *diseases* of old age.

"I really hate death," he says, with a straight face. He speaks with no trace of irony or resignation but rather in the testy, indignant tone one might use to complain about, say, air pollution, or graft at City Hall. "There is no principle in nature," he declares flatly, "which dictates that individual living things, including men, cannot live for indefinitely long times in optimum health."

"Old age is just another disease," says Benjamin Schloss of the University of Buffalo, who is also director of the Foundation for Aging Research in Brooklyn, New York. It is a disease everyone gets, and the individual who survives all the other diseases invariably succumbs to this one. But just because a disease is universal and has always been fatal does not, in Schloss's view, make it inevitably so. Merely to think about aging as a degenerative ailment, rather than as man's eternal and preordained fate, is to put it in the category of a medical problem—something your doctor may some day hope to do something about.

The key to the process of aging may emerge from our new knowledge of the cell. We know that the DNA molecules in the cell's nucleus make up the genes that contain all the basic information for the development and maintenance of life. We have begun to understand

Albert Rosenfeld, the former science editor of Life *magazine, is now working on a book about aging.*

This eight-year-old Brazilian child suffers from progeria, a rare genetic affliction in which the life cycle is strangely accelerated. Death, often from arteriosclerosis, usually comes around age fifteen. In seeking the mechanism involved, scientists hope to better understand the riddle of aging.

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These lively members of the Abkhazian Chorus in the Georgian Republic are all over 100 years old.

how, inside each cell, that information is transmitted via RNA molecules—with the help of enzymes—to carry out the multitudinous, simultaneous activities constantly taking place in the breakdown and buildup of cellular materials, principally proteins. We are, in brief, deciphering the *control* mechanisms of life. If we really do come to understand these control mechanisms, then the controls may pass to us. If the aging process is governed by these same mechanisms, then we can control aging.

Many scientists now think that aging is genetically programmed. In the original fertilized egg it is "written" in the language of DNA-RNA that we will deteriorate and die. If we take a nontheological view, nature's only interest in our individual health and welfare is to see that we survive long enough to reproduce ourselves and to raise a new generation that will do likewise. Once the propagation of the species has been assured, nature is ready to have us make room for newcomers. DNA, the immortal molecule, renews itself through the continuing generations.

An extreme example of the aging process is the Pacific salmon. As it comes in from the ocean, laden with eggs, headed for its freshwater spawning grounds, it is an impressively beautiful fish—a shiny, orange-red creature powerful enough to churn far upstream past rapids and waterfalls. Once it has safely deposited its eggs, however, the salmon deteriorates with appalling swiftness, speeding from youth to senility in scarcely two weeks.

Humans undergo a similar degenerative process after we have passed our reproductive and child-rearing years. But nature gives us (or tortures us with) a longer time to decline. The skin begins to wrinkle and spot. The hair turns gray and thins out. The teeth decay; the eyes grow dim and the ears dull. The muscles get weak and flabby. We all recognize the stooped and shuffling gait that accompanies old age. Meanwhile, internal deterioration also sets in, probably much earlier in life than is apparent from the outward signs. The lungs can't take in as much air as they used to. The heart pumps less blood. The arteries become coated and hardened. The liver and kidneys perform their functions with diminishing efficiency.

The intellect, too, deteriorates. Concentration and learning ability are reduced. After the age of about thirty-five our brain cells die off at a rate of roughly 100,000 per day from an initial total of ten billion or so. Fortunately, the diminution of mental powers does not usually come about until quite advanced ages and is often counterbalanced by wisdom acquired through experience. (Many experts believe that we have greater brainpower, in any case, than we ever make use of.)

Brain cells, once lost, are never replaced. Nor are some of the other cells—those of the heart muscle, for example. But most of the body's cells do replace themselves constantly, simply by continuing to divide whenever replacement is necessary. Even among the dividing cells, though, there is some loss. Nearly all cells lose some of their capacity to retain vital fluids and eliminate waste matter, so they may become clogged and sluggish. Some of them turn into connective tissue, which gets tough and fibrous, like vulcanized rubber. Hence we get drier and stringier as we age. And there is a very substantial loss of tissue—including bone tissue, especially if the individual falls victim to osteoporosis, a fairly common disease of old age. As we grow old, we actually shrink, becoming appreciably shorter and lighter. Moreover, with advancing age, the entire organism becomes less able to deal with stressful situations—and recovers from them more slowly. It loses much of its reserve capacity and falls more easily prey to degenerative diseases—cancer, heart disease, atherosclerosis, hypertension, diabetes, arthritis, senile dementia.

Old people are *expected* to get sick. A doctor's standard comment to a patient, anywhere from thirty-five to ninety-five, is, "You're in pretty good shape *for your age*." Over the years of this century, with the decrease in infant mortality and the conquest of many infectious diseases, more and more peo-

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Is old age written in their genes, or are they just lucky?

ple live to be old. The average life expectancy has been considerably increased, but people who survive to old age don't live any longer than they used to—and often are kept going only through constant medication. Some 10 per cent of the American population is now over sixty-five, and, of these, 86 per cent have one or more of the degenerative diseases.

But no one ever emphasizes the reverse side of these statistics: 14 per cent *don't* have these diseases. Many old people seem to escape the major ravages of aging until they are very old indeed. Why is it that one man is bald and toothless twenty years sooner than his next-door neighbor? What keeps a Picasso or a Casals vigorously creative into his eighties and nineties? Or a statesman like Churchill or Adenauer? Or writer-philosophers like Bertrand Russell and George Bernard Shaw? Right now there are 13,000 people in the United States—more of them women than men—who are over 100 years old. Are they just lucky, or is long life written into their genes?

Leonard Hayflick of Stanford University compares the human organism to a vehicle launched by NASA to fly by Mars and relay information back to Earth. The engineers worry about the soundness of all the working systems—sensors, radio transmitters, rocket engines—all the way to Mars. Once the mission is completed, however, they have no further interest in the vehicle, though it does continue to fly through the universe. How long does it last? Which parts fail first? The experimenters don't care. That's the way nature and evolution seem to "feel" about us, once our propagative function is achieved.

Unlike the Mars spacecraft, however, *we* care what happens to us—and we have independent brains to think with. We have already used "unnatural" means to combat other ailments (God didn't furnish us with scalpels and antibiotics), and now we may discover how to combat the ultimate disease—old age.

Dr. Hayflick's own research may help speed us toward that discovery. It was once believed that cells grown in laboratory tissue cultures were essentially immortal. That is, as long as they were given adequate nutrients and a congenial environment, they would go on dividing forever. But Dr. Hayflick proved that this applied only to abnormal, usually malignant, cell lines. Normal cells have a finite limit. A given normal cell strain taken from an embryo might divide fifty times, for example, and then stop. The older the individual from which the cells were taken, the fewer times they divided.

More and more, it appears that there is a maximum life-span programmed into human genes. If an embryonic cell strain divides, say, twenty times and then is put into the deep freeze for months or even years, it "remembers" where it left off. After thawing, it divides another thirty times—but no more.

Cells taken from the victims of the rare disease called progeria divide only a few times. A child afflicted with progeria runs through his entire life cycle at a strangely accelerated pace. He may begin to show signs of aging by the time he is a year or two old. He may be an old man by seven or eight, shuffling along bald-headed, rheumy-eyed, and heart-troubled, and then die at the age of eleven or twelve.

No one is yet positive that progeria represents a true aging process or that it is genetic in nature, though it does appear to be. But a similar disease, Werner's syndrome, in which the aging acceleration doesn't begin until the teens, is definitely known to be a single-gene disease. If the genetic program can be speeded up by mistake, can it be slowed down on purpose? William Reichel of the Franklin Square Hospital in Baltimore, who is making a study of these ailments, does not consider that a foolish question—though he is not yet close to having the answer.

Neither in a victim of progeria, where the clock of aging seems to run wild, nor in a normal person, are we sure whether the organism as a whole deteriorates, thereby causing changes in the individual cells, or whether senility and death are merely the visible re-

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When young and old cockroaches are joined in "Siamese" fashion (top), the old roach can recover the lost power of regenerating limbs. The Pacific salmon at bottom goes from youth to senility in scarcely two weeks, dying soon after spawning.

flection of what takes place in billions of cells as they slowly deteriorate. Both interpretations may be correct. But what happens in the cell is of critical importance.

Some scientists speculate that as cells age, there is a "blurring" or damaging of the genetic material—that they begin to divide imperfectly or not at all. Even in cells that do not divide, there is a lowered capacity to perform vital functions. This almost certainly means a loss of, or change in, the genetic information, a loss or change that may occur in the DNA itself, perhaps through mutations caused by the chance impact of cosmic rays. Or it may be a loss in the information-carrying, or information-copying, capacity of molecules that transmit the genetic messages or that manufacture the protein. Leslie Orgel of the Salk Institute believes that almost any error, if it occurred in a critical enzyme, could result in a chain reaction of errors—an "error catastrophe" that would interfere with, or altogether stop, protein manufacture. John Maynard Smith of Sussex University in England has suggested that cells might contain certain long-lived, one-time-only proteins—which, when they run down or wear out, are irreplaceable.

Some researchers believe the trouble is due to "cross-linkage" of large molecules that, as the years go by, accidentally become tangled with one another. Others are convinced that "auto-immunity" is a major cause of aging—that the body's natural defenses against disease begin to attack normal cells—either because the information is blurring or because the other cells are changing in ways that make them look "foreign."

Another suspected aging agent is the presence in the cell of "free radicals"—which might be characterized as pieces of molecules eagerly seeking molecules to latch onto. "A free radical," says England's Alex Comfort, perhaps the world's most respected gerontologist, "has been likened to a convention delegate away from his wife: it's a highly reactive chemical agent that will combine with anything that's around." These combinations can have damaging results. They might cause cross-linkage. They could disrupt the information content of important molecules. They could accelerate the formation of hard-to-dispose-of cellular garbage, especially a dark pigment called lipofuscin. Large quantities of free radicals are produced by irradiation; some are also produced constantly by the cell's own oxidation reactions.

The experiments in cooling and parabiosis, already described, prove fairly conclusively that there is nothing immutable about the rate of aging. This conclusion is reinforced by other recent laboratory research in gerontology:

- When young skin cells are transplanted to older animals, they grow old with the animal; but young skin cells transplanted to a *young* animal and constantly retransplanted to other young animals live six times as long as they would have had they been left in the original animal. What do these skin cells get from their hosts that extends their life-span so impressively?
- The rotifer is an aquatic animal tinier than the period at the end of this sentence. Its normal life-span is eighteen days. Charles H. Barrows, Jr., of NIH's Gerontology Research Center in Baltimore has found that reducing the water temperature by 10°C. will almost double the rotifer's life-span. If, at the same time, the amount of food is cut in half, the life-span triples. But different periods of life are affected: food restriction lengthens only the early part, while lowered temperature lengthens only the latter part.
- Experiments conducted years ago at Cornell by Clive McKay also showed that restricting caloric intake prolongs life (in this case, the life of rats)—but again, only the early period of life. A similar stretching out of the earlier life—of mice—was achieved by Denham Harman of the University of Nebraska, who was using antioxidants to combat free-radical damage.
- Roy L. Walford of UCLA has tested the auto-immunity theory by using on mice drugs that suppress the immune system and, by so doing, has apparently been able to retard the aging process.
- Female hormones seem to protect the heart muscle in rats from deteriorating (human females, it may be noted, have a much lower risk of heart attack than do men) and can definitely rejuvenate certain tissues in the reproductive tract of aging women.

In the course of hundreds of gerontological experiments, measurements have been made of the specific changes in cellular function that take place with age. Many enzymes in animal tissues grow less active with age: others, such as LDH (lactic dehydrogenase), increase their activity. Mature DNA has a more tightly folded structure than younger DNA. The RNA content of chromatin increases with age. The liver, lung, and prostate cells of old rats can't synthesize RNA as well as they used to. There are fewer kinds of RNA present as cells age—but some entirely new types appear. Protein manufacturing varies considerably, as does the ratio of DNA to RNA. Antibody production is lower, but the auto-immune response is higher. There are myriads of such changes, few of them well understood, but just about all of them governed by genes.

Can anything yet be done about re-

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versing or interfering with genetic information? Very little at this time, but it is clear that someday we will be able to do a great deal more. If the critical changes are in the RNA molecules or enzymes of the cytoplasm, rather than in the nuclear DNA itself, the task will be more manageable, because the cytoplasm is more accessible than the DNA. At the University of Buffalo, J. F. Danielli and A. Mugleton took a species of amoeba that is essentially immortal and, by transferring cytoplasmic material from a mortal species, conferred upon it the gift of old age and death. There is no reason why refinements of this technique could not accomplish the opposite result.

Tinkering with the DNA presents greater difficulties, but they are not insurmountable. One set of experiments has provided evidence that the decline of RNA manufacture (a process directed by DNA) in the liver of an aging rat could be reversed by the addition of fresh DNA from a young rat. Even more interesting are a couple of recent attempts to remedy human genetic defects:

- In a case described as the first attempt at "genetic engineering," two young German girls suffering from a genetic disease were started on a radical course of treatment. Because their ailment is characterized by low blood levels of the enzyme arginase, their doctors in Cologne gave them injections of a virus that is known to produce very high blood levels of arginase. No one yet knows if the treatment will work.
- In a 1971 experiment at the National Institutes of Health, scientists took skin cells from a patient with galactosemia, a sometimes fatal genetic condition that prevents the body from metabolizing milk. They used a virus called lambda phage, which possesses the missing milk-processing enzyme, and were able to transfer this genetic information via the virus to the skin cells so they could begin to do the job themselves. In a word, they succeeded in artificially imparting the information necessary to correct the inborn genetic error! This is exactly the kind of subtle genetic tampering that may have to be done to correct aging changes.

Fortunately, given the many thousands of genetic changes going on simultaneously at every step of aging, we now know that some substances serve as regulators of whole clusters of activities. In a human disease such as progeria, the speeding up of the genetic program might be due to the absence of one or a few regulator substances that control the clock of aging. Some gerontologists believe that such clock-controlling "pacemaker" chemicals do exist and that they may be depleted or damaged as time goes by—or perhaps

WITH INSTANT BLOOD ANALYZERS IT WILL BE POSSIBLE TO MEASURE THE *RATE* OF AGING.

programmed to disappear at given times. The Pacific salmon's instant deterioration may be related to such a disappearance. In an insect the mere release of a hormone at the appropriate time can trigger an incredibly well-orchestrated sequence of transformations, so radical that the metamorphosed result appears to be an entirely different creature. The hormone orders thousands of events in millions of cells, many of which set off their own built-in self-destruct mechanisms. A scientist who knows how to administer such a hormone doesn't have to understand all the details, any more than we need to understand electrons and tungsten filaments in order to turn on a light.

Searching for such a hormonal solution is W. Donner Denckla of the Roche Institute of Molecular Biology in Nutley, New Jersey. He believes that the clock of aging resides in the brain—specifically in those cells that govern the release of certain hormones. Dr. Denckla is looking for a still-undiscovered "death hormone" or family of hormones whose nature he has theoretically calculated. Released at critical times of life, the death hormones may progressively inhibit cells from utilizing other hormones, probably thyroid hormone. The reason for this suspicion is that hypothyroidism—deficient thyroid activity—closely mimics aging. Its symptoms are reversible through thyroid administration, but only if the patient is young enough. After a certain age people do not seem able to take up thyroid hormone, even if it is present in the bloodstream.

Suppose a scientist already had in hand what he believed to be the pacemaker chemical or chemicals that control the clock of aging—or perhaps, as an interim measure, a "cocktail" containing many of the chemicals known to be depleted with age. He would naturally want to test it on people. Wouldn't it still take many generations, and the use of vast populations, to prove that it was really capable of prolonging life? This has always been one of the discouraging inhibitors to gerontological research in humans: the researcher can't see the results of his work in his own lifetime.

However, this may be changing as medical technology advances. There already exist automated blood analyzers that can, with a single drop of blood, quantify a dozen or more different blood characteristics within a minute or two. Large-scale versions of these are now being developed. If successful, they will be able to analyze hundreds, even thousands, of different substances at once. Dr. Schloss has attained a patent on such a device, and another, based on ultraviolet spectrography, is being developed by Dr. F. J. G. Van den Bosch at the Downstate Medical Center in Brooklyn, New York.

If these devices work as hoped, a single blood sample could tell us a great deal about the functions of the liver, kidney, and other organs in terms of the chemicals they put into the bloodstream. If we can list the significant biochemical changes that take place during aging, then we can measure them all at once in a single person.

By doing this on many persons of different ages over a period of time, we can begin to establish a "biochemical profile" of a person whose average age is, say, thirty. It would also be possible to measure quickly his *rate* of aging over short periods of time. Then one can readily tell if a pacemaker chemical or gene tampering is achieving the goal of prolonging youth.

"This approach," says Dr. Comfort, "reduces the problem of how to retard aging in man to the size of an ordinary medical experiment, using some 500 volunteers over three to five years, like the assessment of low-cholesterol diets in heart disease."

There are some things gerontologists do *not* especially want to do:

- They have little interest in stretching out the years of senility, to keep people alive in a state of helpless decrepitude —though they would certainly like to relieve the aches and anxieties of this period and, if possible, undo some of the damage.
- They do not want merely to prolong the years of childhood, as has been done in rats and rotifers through restrictive feeding—though the ability to achieve this might have some interesting possibilities.
- They do not seek to "prolong" life by inducing periods of hibernation during which a person would continue to exist in a state of suspended animation—like Dr. Hayflick's deep-frozen cells—to be awakened for intermittent periods of active life. This might be a fascinating experience, even a useful one—especially for long space voyages—but the total years of wide-awake life would remain three score and ten.

What the gerontologists *do* want to do is to extend the number of continuous years spent at a productive and enjoyable level of health and intellectual power. Presumably no one would be required to go on living, but those who wanted to would have the option. Given a real choice of prolonged *good* years, how many would turn it down? □

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The Rout in Executive-Suiteland

BY DANIEL S. GREENBERG

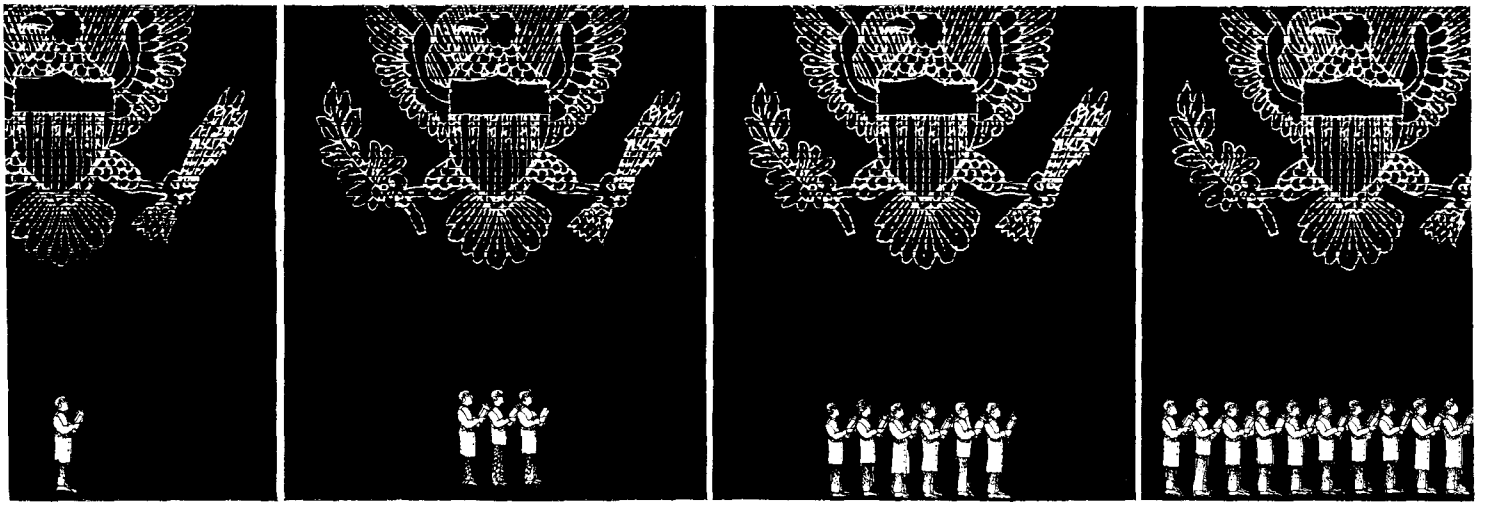
A complete body count of Mr. Nixon's postelection massacre of the upper echelons of the federal bureaucracy is yet to be tallied, but it is doubtful that any segment can match the casualty rate of the scientific and technical services.

Gone is the President's science advisor, Edward E. David, Jr., who resigned three weeks before it was announced that his post is to be abolished along with the organization he directed, the Office of Science and Technology, and its fifty-member staff. John S. Foster, Jr., the Pentagon's research chief, is going. Robert Q. Marston, director of the multibillion-dollar National Institutes of Health—formerly exempt from politically inspired personnel changes—was handed his notice and has stepped down. Harold B. Finger, assistant secretary for research and technology at the Department of Housing and Urban Development, is also going, as are many of his counterparts in other cabinet-level departments.

Not long ago fears were frequently expressed about the ascendancy of technocrats in government and about threatened usurpations of constitutional processes by Strangelove types on detached duty from our more prestigious institutions of higher learning. The Nixon-inspired rout should dissolve that chimerical fear, for Mr. Nixon, despite his regal conception of the office, has shown no disposition to offend any of the real powers on the American landscape, such as big business or organized labor. What, then, is happening vis-à-vis government and science?

From the perspective of the shocked bureaucracy, looking at calendars full of now-canceled meetings and unfinished reports, the situation is calamitous, comparable to the sudden descent of a lethal plague on a happy community. For example, writing in the *New York Times* last month, Wilbur J. Cohen, former secretary of health, education, and welfare and now dean of the School of Education at the University of Michigan, labeled the HEW ousters "an ominous omen of worse things to come" and gloomily described Marston's NIH directorship as "vital to continued expansion of our medical research capacity." Whether medical research should be expanded, and, if so, why a successor to Marston cannot lead it, were not discussed. The issue is simply the decimation of the bureaucracy.

The rest of us, however, can properly afford to take a cooler view of the matter. The President has chosen to behave callously toward a lot of people who served both him and the nation well and loyally, and he merits poor grades for courtesy; but the disaster that has struck executive-suiteland is essentially self-contained and carries fewer implications than meet the eye.



First of all, a good number of the newly vacated posts will be refilled, though the newly exiled will naturally declaim about the quality of their replacements. More important, the public humbling of the scientific and technical bureaucracy simply institutionalizes what was happening anyway, though mostly out of public view. Nixon inherited a scientific and technical superstructure that was installed in Washington long ago by politicians awed by the mysteries of the atom and space. Starting about halfway through

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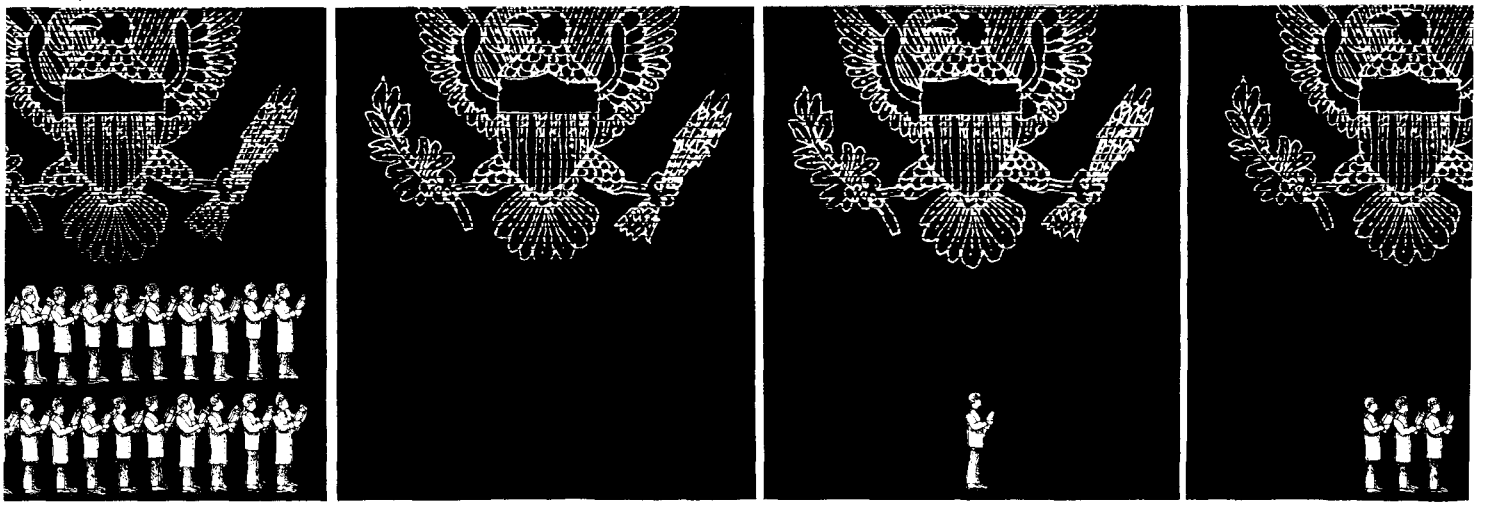
Kennedy's term and then accelerating rapidly under Johnson and Nixon, an incongruity developed between the formal location of science advisors in the federal hierarchy and the contributions that those advisors could make. The disparity was most glaring in the case of the science advisor to the President [see "David and Indifference," *SR of The Sciences*, October 1972], a post created by Eisenhower in the wake of Sputnik. There it was, high up on the White House staff, one of a half a dozen or so special assistantships to Presidents who increasingly were concerned, not with missiles or space, but with Vietnam, civil rights, crime, the economy, reelection—all of which involve some element or other of science and technology but never in the dosage that required a science advisor at the presidential elbow. Most often, the advisor and his staff were simply ignored or were assigned busywork.

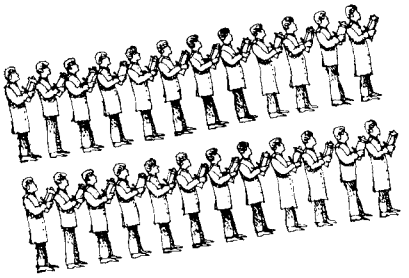
Further diminishing the thirst for presidential science advice was the development of sizable research staffs inside government departments with operational responsibility for the goals of the White House. Ironically, most of these were installed at the recommendation of the White House science advisory apparatus, the immutable law of bureaucracy being that proliferation signifies strength and power, paving the way for further proliferation. But many of the newly installed departmental research staffs fared no better than their forebears at the White House. For example, since 1962, when the Commerce Department created the position of assistant secretary for science and technology, it has huffed and puffed about focusing the forces of research on the assorted malaises of American industry. However, the record of achievement is sparse, and in Nixon's first term Commerce managed to run through two such assistant secretaries, followed by a fill-in on an acting basis for over a year, with industry neither better nor worse off for the exercise. Housing and Urban Development would seem to be a natural for the benefits of science and technology, but under George Romney that benighted department has been a model of indifference to its research staff.

The irrelevance of scientific and technical expertise to Nixon's style of government is so great that the original postelection plan was simply to dismantle the White House science office and drop the matter there. Sager minds offered the thought that, with the government spending some $17 billion a year on research and development, it might, after all, be useful to have a professional staff looking after the priorities and numbers. It was then proposed that a scientific staff be incorporated into the Office of Management and Budget, the fiscal ringmaster for the White House, but OMB prides itself on general rather than specialized talents and declined the offer. Finally, it was decided to attach the advisory function to the National Science Foundation, a shrimp-size federal agency that is mainly concerned with academic science and education, though lately it has been getting into industry-related research. Giving the task to NSF is like assigning General Motors' Frigidaire Division to maintain surveillance over the entire corporation.

While the riddled bureaucracy and its friends indulge in lamentation, the essential point, it seems to me, is that the President cannot be expected to heed advice that he won't hear, and this President is not disposed to hear the advice of specialists whose elevated stations originated in other times. C. P. Snow counseled governmental deference to scientists because they "have the future in their bones." Perhaps. But the bureaucracy that Nixon chased out rarely, if at all, foretold the future, and as for its management and application of the nation's scientific and technical resources, the record there is spotty. (Disciples of the future-in-their-bones school might, for example, compare the present-day oversupply of physics graduates with the shrill predictions of a shortage just a decade ago.)

One safe prediction, based on historical precedent, is that if too many difficulties ensue from the absence of science advice in the right places, science advice will begin to trickle into those places anyway, as it did at the beginning of World War II, when Roosevelt was alerted to the possibility of building an atom bomb. Eventually, a committee of management specialists may conclude that the White House needs its own science staff, right on the premises, and, once installed, that staff will conclude that the cabinet departments should be more alert to scientific expertise. It's a ridiculous way to run a government, but that's how we do things in the United States. □





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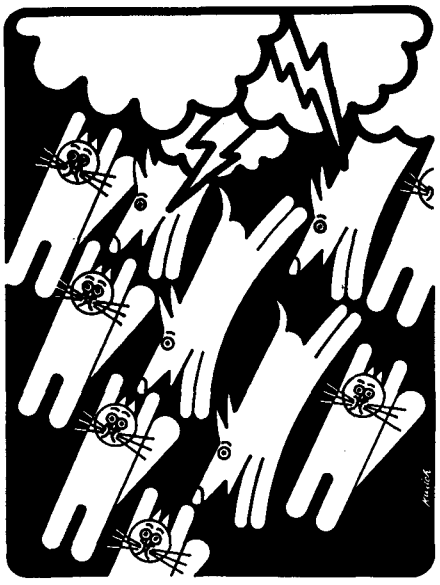
LIFE SCIENCES

ZPG for Spot and Kitty

As if the human population problem were not enough, we are now faced with the consequences of our pets' prolificacy. Due to early puberty, large litter size, and shorter pregnancy, dogs are about fifteen times as fertile as humans and cats thirty to forty-five times. We wind up destroying about 13.3 million dogs and cats each year at an annual cost near $100 million.

In an article in *Science and Public Affairs*, formerly called *Bulletin of the Atomic Scientists*, Carl Djerassi, Andrew Israel, and Wolfgang Jochle demonstrate the enormity of the current pet population explosion. Six billion pounds of dog and cat food were consumed during 1971, for example; the combined costs of food, purchase, and licensing and veterinary fees for dogs and cats now exceed $4.5 billion a year.

In the face of such overwhelming fertility (every hour some 2,000 to 3,500 dogs and cats are born in the United States versus 415 humans) the authors are pessimistic. For the present they can offer only short-term cures, such as surgical sterilization, higher licensing fees, and taxes on pet foods. They estimate that it will take ten years to develop effective chemical contraceptives for dogs and cats. □

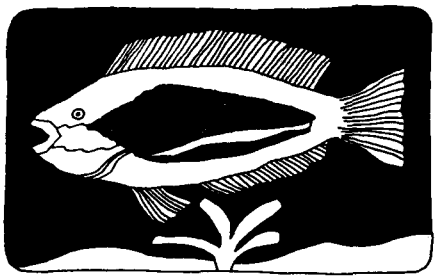


Shell-Collecting Fish

"Most people," writes malacologist R. Tucker Abbott, "including the native fishermen of remote tropical shores, are poor shell hunters." Aside from the molluscan challenges of camouflage, minute size, and a dislike for sunlight, he writes, "even a well-experienced malacologist suddenly placed in a new habitat will take five or ten minutes to 'turn on his collecting eyes.'"

One solution—especially in searching for the rarest mollusks—is to let fish do the collecting. According to Dr. Abbott, who is head shell scientist at the new Delaware Museum of Natural History and one of the world's leading conchologists, shells extracted from the stomachs of fish have netted over $20,000 from collectors in the last four years. Fish serve as invaluable intermediaries, because many of them find tasty—and rare—shells in shallow-water habitats inaccessible to man.

Dr. Abbott writes in his lavish new book, *Kingdom of the Seashell*, that collectors in South Africa, the Philippines, and Brazil are finding their choicest specimens by catching and "opening" shell-eating fish. Rarest of all *ex pisces* species is the Du Savel Cone—known only from one specimen retrieved from a fish caught off Mauritius in 1871. □



CO_2 vs. Eutrophication

With the eruption of environmental concern, "eutrophication" almost has become a household word—quite an accomplishment for a noun that size. All lakes and ponds eutrophy, or age, as they gradually fill up with plant matter, but modern civilization is drastically accelerating this process by adding to water supplies unnatural amounts of plant nutrients, such as phosphates from fertilizers and nitrogen from human sewage and cattle feedlots. Shallow lakes with poor circulation, such as Lake Erie, eutrophy most readily, and the public has become sufficiently alarmed to pick up a smattering of limnology.

This smattering consists, for the most part, of the knowledge that eutrophication involves unusual blooms of algae that deprive fish of their oxygen supply. These blooms generally feature the dominance of blue-green (rather than green, red, or brown) algae, a type considered undesirable since it forms floating scum and contributes little to the natural food chain leading to fish.

What follows from this knowledge is the suggestion that the unnatural nutrient supplies be cut off so as to starve the algal blooms. This approach, however, is complex and time consuming. Few people have asked the obvious question: Why should blue-green algae dominate in supernutrified ponds and lakes?

Joseph Shapiro of the University of Minnesota has investigated this dominance by raising a dozen different communities of mixed algae. Confining his communities to large plastic bags suspended from a raft in Lake Emily, near St. Paul, he varied such environmental features as the concentration of nutrients, amounts of CO_2, and the acid base quality of the water. Shapiro reports in *Science* magazine that blue-green algae are far more efficient than competing types at utilizing low level of CO_2 and hence better adapted to flourish in lakes with poor circulation.

On the other hand, when Shapiro added abundant CO_2 to one of his bags, the more desirable green algae quickly predominated. The author speculates that his results might be used therapeutically to combat eutrophication: "It would be reasonable to investigate the effect of the injection of CO_2 with or without air into lakes as a means of stimulating the growth of green algae at the expense of the blue-green algae." □

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SOCIAL SCIENCES

Sane Insane Sane Insane Sane Insane Sane Insane SaneInsane

David Rosenhan and his seven colleagues followed identical experimental routines. Each would voluntarily make an appointment with a mental hospital admissions office, and each would tell the same story:

They were hearing voices, unclear voices, that seemed to be saying words like "empty," 'hollow," and "thud."

That's all; no other symptoms—just the words. But for the admitting psychiatrists in twelve hospitals the words were quite enough. They were, in the jargon, auditory hallucinations, reflecting painful concerns about the perceived meaninglessness of life.

The volunteers offered no further untruths beyond false names; all stuck scrupulously to the facts of their true life histories. Yet seven of the volunteers, including Rosenhan, found themselves tagged with the same diagnosis —schizophrenia. The eighth was diagnosed as a victim of manic-depressive psychosis.

The diagnoses stuck. The eight pseudopatients, duly admitted to mental wards, were incarcerated for between seven and fifty-two days before being released. Average confinement time was nineteen days. Not a single initial diagnosis was questioned by any staff member in any hospital. Not a single pseudopatient was released as cured—"in remission" was the uniform final diagnosis. They behaved calmly, but that did not seem to matter. During their hospitalization the pseudopatients were given a total of nearly 2,100 tranquilizer pills. (They threw the pills away in the toilets—as did many real patients—unobserved by staff.) Therapy was minimal; the pseudopatients received a total of 6.8 minutes of contact a day from psychiatrists, psychologists, residents, and physicians.

David Rosenhan, the leader of this unique experiment in Kafka-tripping, is a professor of psychology at Stanford University. His colleagues (all, like himself, at least presumably sane) were a varied lot: a psychiatrist, a housewife, a painter, a pediatrician, two more psychologists, and a psychology graduate student. Their experiment was admittedly without controls, but it revealed much about the nature of psychiatric diagnosis as self-fulfilling prophecy, about the unchallengeable fixity of the diagnostic label, and about the despairing, painful powerlessness and depersonalization that afflict the so-called insane in mental hospitals.

Rosenhan recently published the results of his three-year research effort in *Science*, the journal of the American Association for the Advancement of Science. "It is clear," he wrote, "that we cannot distinguish the sane from the insane in psychiatric hospitals. How many people, one wonders, are sane but not recognized as such in our psychiatric institutions? How many have been needlessly stripped of their privileges of citizenship? A diagnosis of cancer that has been found to be in error is cause for celebration. But psychiatric diagnoses are rarely found to be in error. The label sticks, a mark of inadequacy forever."

The psychologist's indictment did not surprise leaders in the mental health profession. "Temperate, reasonable, and accurate" was how the article was described by Dr. James M. Stubblebine, California's mental health chief, who is now taking over all the state's health care programs. Aided by far-reaching new legislation, Stubblebine is phasing out virtually all of California's big state hospitals in favor of community mental health programs.

"Too many mental health professionals focus excessively on symptoms without examining their patients as human beings," Stubblebine said. "We don't need to confine people, even when they do display symptoms; we don't have to infantilize them. Instead, we should help them deal with reality outside of institutions."

Rosenhan's detailed report was filled with incidents that underscored his conclusions.

On diagnosis as prophecy: The pseudopatients kept careful notes each day. Nurses and doctors ignored the note taking, except for some who saw it as proof of insane compulsiveness. "Patient engages in writing behavior" was one daily comment in a nursing chart. (Patients, the supposedly insane ones, were sharper in their diagnosis of what was amiss. Thirty-five said such things to the note takers as, "You're not crazy. You're a journalist or a professor. You're checking up on the hospital.") Said Rosenhan: "A psychiatric label has a life and an influence all its own. Once the impression has been formed that the patient is schizophrenic, the expectation is that he will continue to be schizophrenic. . . . Indeed, the label is so powerful that many of the pseudopatients' normal behaviors were overlooked entirely or profoundly misinterpreted."

On depersonalization: The pseudopatients recorded nearly 1,500 instances when they approached staff with perfectly reasonable questions. Nurses and attendants moved hurriedly away, eyes averted, 88 per cent of the time. Psychiatrists ignored the questioners 71 per cent of the time. One pseudopatient asked, "Pardon me, Dr. X, but could you tell me when I am eligible for grounds privileges?" The doctor's bizarre response was "Good morning,

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Dave, how are you today?" And he rushed off, without waiting for "Dave" to answer.

On Powerlessness: "Come on, you m- - - - - f - - - - rs, out of bed!" was the morning call of attendants on one ward, and no patient dared demand respect. On another ward Rosenhan himself testified he saw a patient beaten for approaching an attendant and saying nothing worse than "I like you." Abuse was common in some hospitals. "Neither anecdotal nor 'hard' data can convey the overwhelming sense of powerlessness which invades the individual as he is continually exposed to the depersonalization of the psychiatric hospital," Rosenhan commented.

When the experiments were complete, Rosenhan informed the hospitals involved of what he had been up to. Skeptics in one hospital insisted that the records of false diagnosis could not possibly be true. So Rosenhan told the hospital's psychiatric staff he would send them one or more pseudopatients. The staff took extra care in screening, and of the next 193 admissions 41 patients were alleged "with high confidence" to be pseudopatients. But they weren't; not one of the patients suspected as "sane" was a member of the experimental team, Rosenhan revealed later. Were they therefore "insane"?

There is no doubt that mental illness is anguishing, that psychological pain can be profound. But Rosenhan asks the crucial question: "If sanity and insanity exist, how shall we know them?" DAVID PERLMAN

Happy Ending?

Last year two sociologists reported that in modern industrial societies more women than men are mentally ill. In a second article, appearing in the journal *Social Forces*, one of the two sociologists, Walter R. Gove, took a closer look at the findings and discovered:

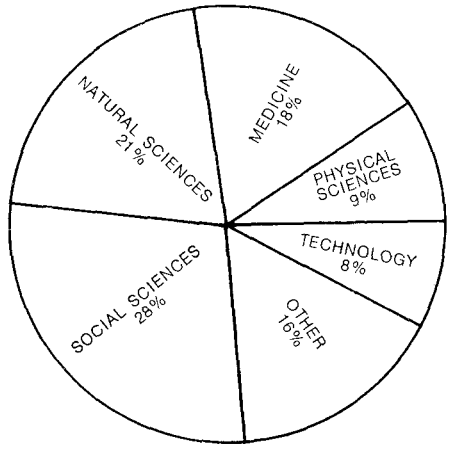
1) single (never-married) men have slightly higher rates of mental illness than their female counterparts;
2) widowed or divorced men have slightly higher rates than widowed or divorced women;
3) married women have considerably higher rates than married men; but
4) single men and women have higher rates than married men and women.

From these findings Gove concludes that, although marriage has its advantages (no. 4), "being married is considerably more advantageous to men than it is to women [no. 3], while being single is, if anything, slightly more disadvantageous to men than to women" (nos. 1 and 2). □

Science in the News

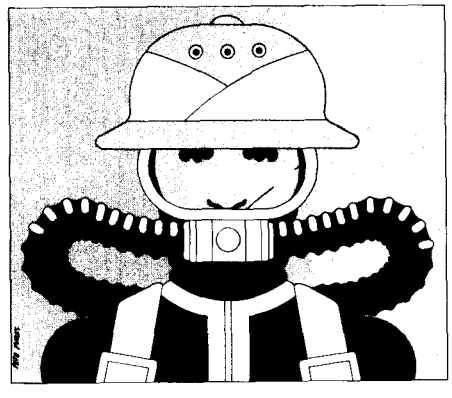
How does Joe Doe keep abreast of science? Through newspapers, of course. In fact, a study done ten years ago showed that the general public gets a full 80 per cent of its science information from newspapers. Assuming that television hasn't encroached much in this area and being curious as to how much science is actually reported in newspapers, anthropologist William Divale recently surveyed eight major newspapers and found that only 3.3 per cent of their contents could be considered science news. (How this percentage is divided is shown in the graph below.)

Although Divale concludes that the overall quality of science reporting is outstanding, he feels the amount of reporting is alarmingly small, considering the importance of science and technology in our society. □



Wet Archaeology

Those relative newcomers to anthropology, the underwater archaeologists, held their Fourth International Conference, January 11 to 13, in St. Paul, Minnesota. Expanding their field to include sites buried in mud or only partly covered by water, these archaeologists, because of new technology, can now devote more time to the historical content of their work than to the machinery of excavation and the safety of diving. The papers delivered at the meeting covered many aspects of "wet" archaeology, such as recently discovered historic shipwrecks, sunken cities, art objects and artifacts found beneath the sea, and restoration techniques.



Scientists also reported on the various tools used, which included not only the usual scuba gear and airlifts but also sonar devices for locating wreckage, magnetometers for finding metal-bearing ships, instruments for penetrating deep mud, underwater television cameras, and kites and balloons for aerial photographs of submerged sites in clear water.

The following were among the more significant reports:

- Plans to raise the *Amsterdam*, a 150-foot ship grounded in quicksand at Hastings, England, in January 1747, were presented by Peter Marsden of London. Marsden reports that the ship remained with its sides projected above the sand for several hundred years. At present, however, the *Amsterdam* is uncovered for only one or two hours during two or three days of every month. Three-quarters of the ship is still intact and is thought to be in an excellent state of preservation. The ship will probably be excavated by Dutch archaeologists and floated back to Amsterdam for permanent display.
- Robert Marx of Florida reported the recent discovery of the galleon *Nuestra Señora de las Maravillas*, sunk New Year's Day, 1656, on the Little Bahama Bank. Marx said the galleon was the vice admiral's ship of the armada carrying a large treasure back to Spain. Magnetometers were used for locating the 650-ton wreck. Among the finds were gold and silver coins minted in Peru and bearing the stamp of Philip IV, uncut gems, swords, navigational equipment, and some Aztec and Mayan art objects.
- The restoration of five Viking ships, sunk in Roskilde Fjord around 1000 A.D., was described by Ole Crumlin-Pederson of the National Museum of Denmark. Many of the timbers were well enough preserved to permit accurate reconstruction of the vessels. (Before reconstruction, the wood is soaked —sometimes for several years—in a water-soluble synthetic wax to prevent shrinkage when exposed to air.) One vessel has already been completely restored.
- Nicholas Flemming, of the National Institute of Oceanography, England, discussed the theory of continental drift and its consequences for archaeologists. Because of the Anatolian Fault (which runs east-west through Turkey and into the Aegean), most of the Mediterranean is seismically active. As a result, there are many submerged cities in the areas of southeast Sicily, Calabria, and the Bay of Naples. BARBARA HEINE

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PHYSICAL SCIENCES

Celestial Maternity Ward

Three Cal Tech astronomers—Gareth Wynn-Williams, Eric Becklin, and Gerry Neugebaur—have discovered what they believe to be a rare group of embryo stars—stars still in the process of condensing out of a cloud of interstellar gas. These embryo stars were found in a dense cloud of gas and dust located some 10,000 light years from our Milky Way Galaxy.

The cloud, called W3, is so opaque that until recently it was thought to contain only several fairly young stars. Now, thanks to a series of infrared studies, it is believed that the cloud is a veritable maternity ward for celestial births.

One of the newly discovered embryo stars, called IRS-5 (for infrared source number 5) emits 30,000 times more energy than the sun and is larger than the entire solar system. Its temperature, however, is only 170 degrees Fahrenheit, extremely cool when compared with the 5,000 or more degrees of a normal star. Thus, it is believed that the embryo is in the process of collapsing under its own gravitational forces and that over the years it will become more compact and much hotter. In the meantime, however, the embryo star is of great interest to astronomers because it is also a "maser," emitting intense radiation at the precise wavelength of the water molecule.

One of the reasons the Cal Tech scientists believe IRS-5 to be an embryo star is that it is located only a few light years away from several extremely young hot stars, probably born within the last 10,000 years—an extremely short time by astronomical standards. Also, the cloud surrounding IRS-5 contains vast amounts of hydrogen, the raw material from which stars form.

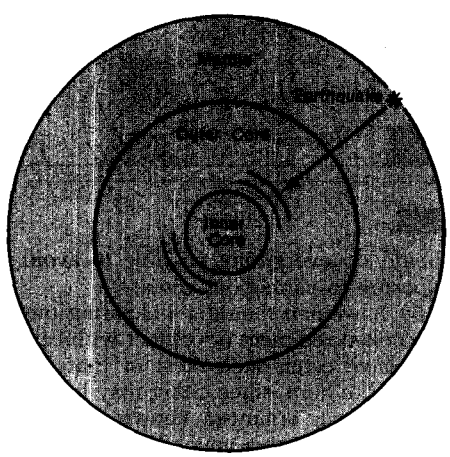
Only one other embryo star is known to astronomers with any certainty. It is located in the Orion Nebula. However, IRS-5 is of special interest, for it is more energetic than the Orion embryo and may eventually become an exceptionally bright star. □

Earthquakes and Magnetism

It is generally believed that the magnetic field of the earth is caused by a flow of molten metal in the planet's fluid outer core. This line of thinking is known as the geomagnetic dynamo theory. However, scientists have not been in agreement as to the power source of this flow of liquid metal. Several possible sources have been proposed, among them the earth's rotational energy and the heat of fusion caused by the freezing of fluid in portions of the outer core itself.

Now a new source has been suggested—earthquake energy. According to John T. Kuo and I. J. Won of the Columbia University School of Engineering and Applied Science, about .05 per cent of the energy of a large earthquake impacts the earth's solid *inner* core, causing it to oscillate in the liquid outer core. The two scientists state that the oscillation "can generate the velocity field in the fluid outer core that is required by present geomagnetic theory."

Kuo and Won calculate that a magnitude 8.5 earthquake, such as the one that shook parts of Alaska in 1964, causes a small oscillation (60 centimeters amplitude) that repeats every seven hours and twenty-four minutes. The oscillation is such that it could continue for as long as 10,000 years. Furthermore, the size or amplitude of the inner core's oscillation varies. Magnitude 8.5 quakes, for example, have occurred as often as every ten to twenty years. Depending on its timing, a large quake could either cancel or reinforce the oscillation of the inner core. □

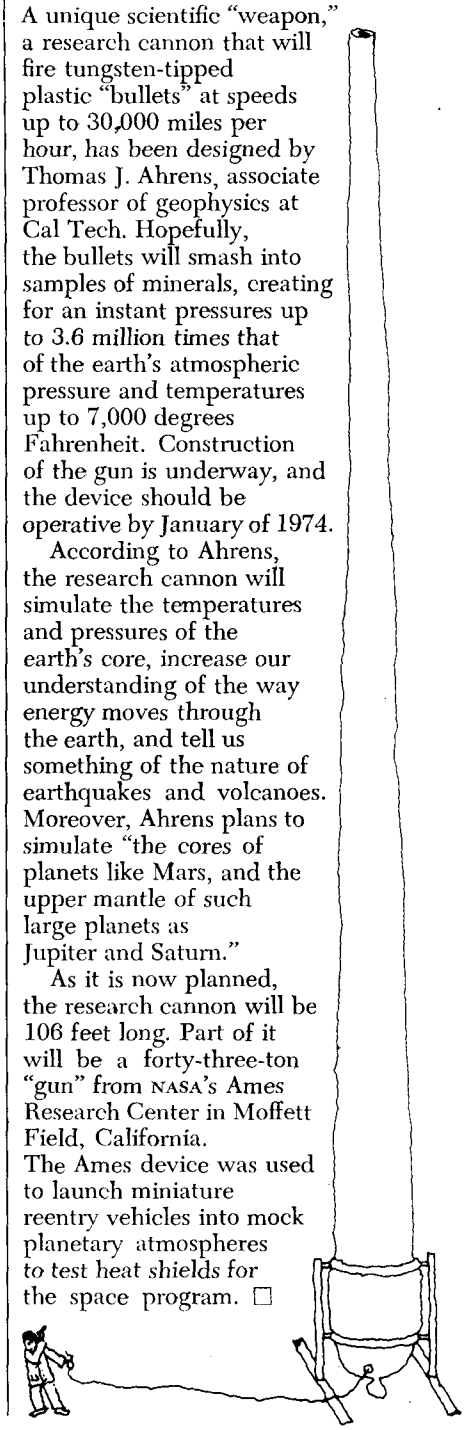


The Fastest Gun in the West

A unique scientific "weapon," a research cannon that will fire tungsten-tipped plastic "bullets" at speeds up to 30,000 miles per hour, has been designed by Thomas J. Ahrens, associate professor of geophysics at Cal Tech. Hopefully, the bullets will smash into samples of minerals, creating for an instant pressures up to 3.6 million times that of the earth's atmospheric pressure and temperatures up to 7,000 degrees Fahrenheit. Construction of the gun is underway, and the device should be operative by January of 1974.

According to Ahrens, the research cannon will simulate the temperatures and pressures of the earth's core, increase our understanding of the way energy moves through the earth, and tell us something of the nature of earthquakes and volcanoes. Moreover, Ahrens plans to simulate "the cores of planets like Mars, and the upper mantle of such large planets as Jupiter and Saturn."

As it is now planned, the research cannon will be 106 feet long. Part of it will be a forty-three-ton "gun" from NASA's Ames Research Center in Moffett Field, California. The Ames device was used to launch miniature reentry vehicles into mock planetary atmospheres to test heat shields for the space program. □



Cyclops Report

Conducted in the summer of 1971 by Stanford University and the NASA/Ames Research Center, Project Cyclops assessed the hardware, manpower, time, and funding required to mount a realistic effort to detect extraterrestrial intelligent life. A copy of the 241-page project report now can be obtained by writing Dr. John Billingham, NASA/Ames Research Center, Code LT, Moffett Field, California 94035. □

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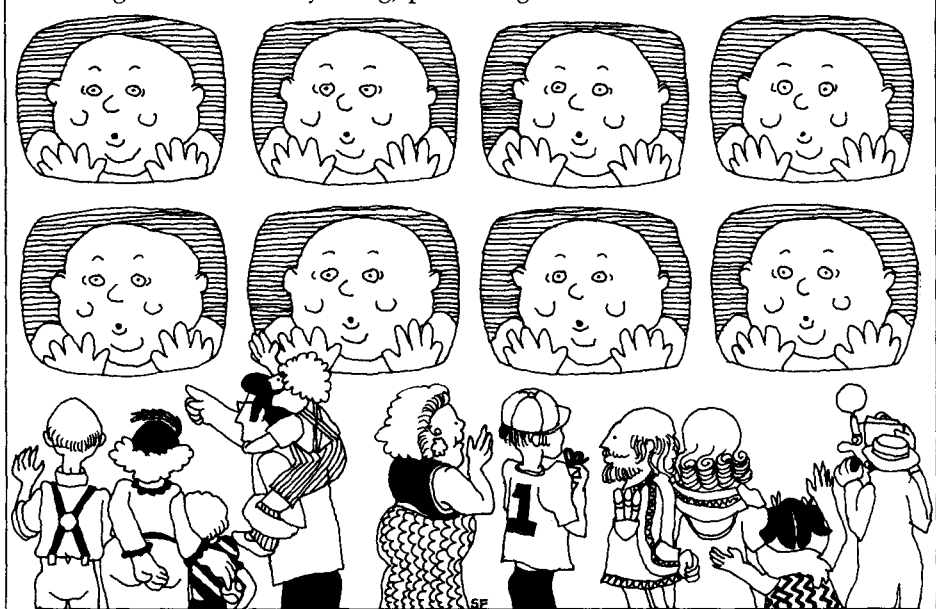
HEALTH & MEDICINE

Dial-a-Baby

In its constant quest to complicate essentially simple matters, medical science has achieved startling heights, but none so touching as the Dial-a-Baby service now available in at least one California hospital. If a woman gives birth at the Martin Luther Hospital in Anaheim, her older children no longer have to wait anxiously at home to see their new baby brother or sister. Dad can bring the whole family along, pick up a special phone in the lobby, and dial the nursery. Via a remote video arrangement, the image of the new arrival is beamed to a closed circuit TV screen. Admittedly, this is at least one step removed from looking through the glass partition and therefore virtually germproof. But wouldn't it be simpler —and less expensive—to have the kids wash first and, on the way upstairs, tell them to be very quiet for the benefit of those maternity "patients" who might not like children? □



Precautions for Prospective Parents

It will be some time, more likely decades than months, before science has arrived at the stage where it is able to cure most birth defects and prevent those that it cannot cure. But there are a number of common-sense precautions every prospective parent should know.

1) A hereditary condition in the family means that one should get some genetic counseling.

2) It is best for a woman to have her children between the ages of twenty and thirty-five, with at least two years between the end of one pregnancy and the beginning of another; the father should be younger than forty-five years old.

3) Intercourse should take place at intervals of no more than twenty-four hours for several days just preceding and during the estimated time of ovulation.

4) No woman should become pregnant unless she has had German measles or has been effectively immunized against it, and during pregnancy she should do everything possible to avoid exposure to contagious disease.

5) A woman should avoid eating undercooked red meat or contact with cats that have eaten such meat or that are allowed to hunt, since either may be the source of an organism known as toxoplasma that causes major birth defects.

6) A woman who is pregnant or who thinks she is should not be exposed to X rays or take any drugs (except under the instructions of a doctor who has been told of her pregnancy).

There are several other items, including good prenatal care, not smoking cigarettes, and getting appropriate treatment if she is Rh negative, that most obstetricians tell their patients once pregnancy has been established. Practicing these guidelines won't guarantee a healthy, normal baby, advises pediatrics professor Virginia Apgar in *Is My Baby All Right?* published earlier this year. But they will greatly increase a couple's chances of having children free of congenital handicap. □

Foresight

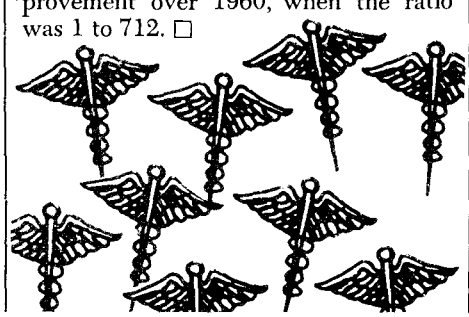
One of the best ideas in a do-it-yourself package to appear in a long time is the Home Eye Test Kit available free of charge from the National Society for the Prevention of Blindness in New York City. The test, based on a scaled-down version of the standard eye chart, enables parents to detect in their preschool children certain vision troubles that might interfere with learning ability. It is scored on a simple pass/fail system. Should the child fail, the parent is advised to seek professional services. An early eye examination can catch and often lead to prompt correction of vision problems that affect approximately one out of every twenty children under the age of five. □

The Cost of Reading

The high cost—in time as well as dollars—of keeping educationally up-to-date in medicine is a commonly registered professional complaint. With all the journals and miscellaneous literature that flood his desk, a doctor could spend much of his time by simply reading about diseases rather than by treating them. Obviously, this would not do his patients a great deal of good. To draw the line, but not to advise what he should read, a *New England Journal of Medicine* editorial offered the following elementary lesson in discernment: "For about $75 a year (really $30 to $40, depending on income-tax brackets) the American physician can obtain four or five medical journals that, if read carefully—and perhaps even painfully—will provide him with all the new information he could possibly make use of." Subtract $15 for the *New England Journal*—it will make a nice gift for any doctor who doesn't already get his weekly copy. □

Is There a Doctor in the House?

To this question the American Medical Association reports a resounding yes. At the beginning of last year there were 345,000. That's one for every 612 of us patients, which is an improvement over 1960, when the ratio was 1 to 712. □



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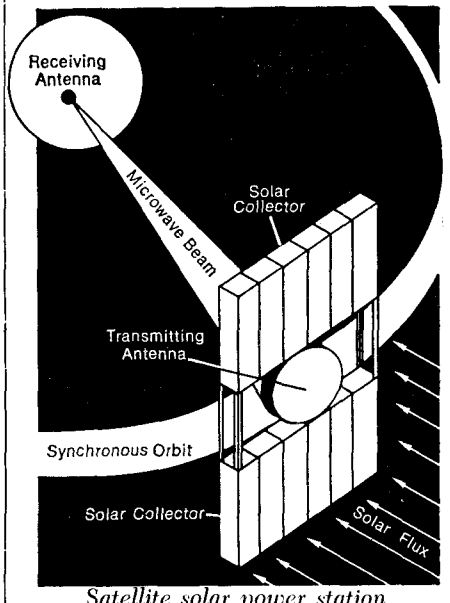
TECHNOLOGY

Satellite Follows the Sun

Solar energy, an alternative to conventional power sources, could be tapped nearly twenty-four hours a day by a satellite circling the earth. The satellite would receive six to fifteen times the solar energy available at any terrestrial spot in the United States, since sunlight is limited by weather conditions and night.

The satellite idea was proposed by Peter E. Glaser, vice-president of Ar-



Satellite solar power station

thur D. Little, Inc., in Boston. He describes a future satellite solar power station: "Two symmetrically arranged solar cell collectors convert solar energy directly to electricity. This electricity is fed to microwave generators arranged to form an antenna between the collectors. The antenna directs a beam to a receiving station on earth where the microwave energy is safely and efficiently converted back to electricity." With improvements in existing technology, transmitting efficiency from space to earth in any weather could reach 70 per cent.

The coming space shuttle program could provide necessary support for the giant satellite stations. According to Glaser, they could be operational by the year 2000 at a cost competitive with earthbound power generators. Now working on a feasibility study for NASA, he foresees that a network of power-generating satellites could meet a significant portion of U.S. energy demands, without draining valuable earth resources. □

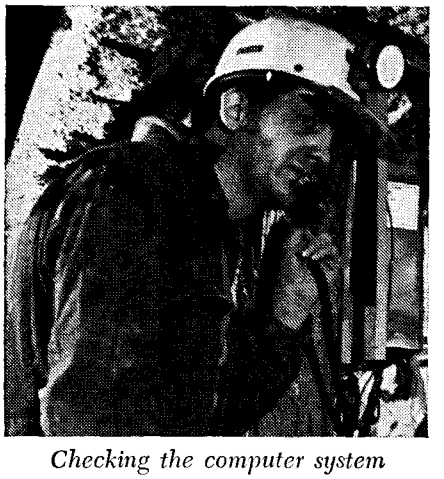
Computerizing Coal Mines

There was a time when canaries were used in coal mines to detect deadly carbon monoxide, a colorless, odorless gas given off during mine fires. Today most mines simply monitor mine ventilation and concentration of methane gas, the cause of most coal mine explosions. However, many disastrous fires and explosions in the nation's coal mines might have been prevented had underground passageways been checked by a new computer system now being developed at West Virginia University.

Considered the most comprehensive monitoring system in coal mining history, it is programmed to check continuously the concentrations of methane, oxygen, and carbon monoxide, as well as air flow, pressure and temperature changes, and relative humidity of an active coal mine. Tests are now underway in a mine section near Miracle Run, West Virginia.

Dr. Melvin D. Aldridge, director of the project, notes that only a computerized system could provide an instantaneous check on conditions in the vast uninhabited area of a coal mine. "Major coal mines are larger than most people think," he says. "Some are larger than Manhattan Island and have more miles of passageways than New York City has streets."

The new monitoring system consists of groups of sensors placed strategically within the mine, data relay stations, and a centrally located digital computer that processes hundreds of incoming measurements. Having confirmed the accuracy of their measurements, WVU engineers are now programming the computer to assess automatically when and where abnormal conditions exist.



Checking the computer system

By calculating changes in air resistance, for example, it could detect roof falls. Fire would be indicated if concentrations of carbon monoxide, a drop in oxygen content, and a rise in temperature were detected. □

The Gasoline Gluttons

Car owners often blame emission-control devices for the poor gas mileage they get with their new vehicles. They fondly remember those pre-1968 days when, it seems, cars had a more easily slaked thirst.

According to a recent study by the Environmental Protection Agency, however, the real culprits are the greater weight of today's automobiles and the increased use of air conditioning. Data from 2,000 cars—pre-1968 through 1973 models—shows that the loss of gas economy due to pollution-control systems was under 8 per cent. In contrast, the loss due to air conditioning averages about 9 per cent but can go as high as 20 per cent for urban driving on hot days. A loss of 6 per cent was reported for cars with automatic transmissions.

The largest drain on the gas tank is caused by increased vehicle weight. Under urban driving conditions, this loss in fuel economy can be as much as 50 per cent. For example, a new 5,000-pound vehicle gets about ten miles to the gallon, whereas 2,500-pound cars average about 20 mpg. Even vehicles named after the same wild animal have become heavier—a 1958 Chevy Impala, for example, weighs 1,500 pounds less than the 1973 model. Furthermore, fuel economy suffers another setback with the highly touted Wankel engine —about a 35 per cent loss in fuel economy when compared with vehicles of the same weight equipped with conventional power plants. □

Electronics on Display

A television tube constructed by inventor Philo T. Farnsworth in 1924 and the equipment used in the world's first regularly scheduled radio station (founded 1909, San Jose, California) are among the electronic treasures housed in a new museum at Foothill College. Located less than an hour's drive south of San Francisco in Los Altos Hills, the unique Electronics Museum displays the evolution of commercial radio and television and even allows visitors to experiment with electrical gadgetry. □

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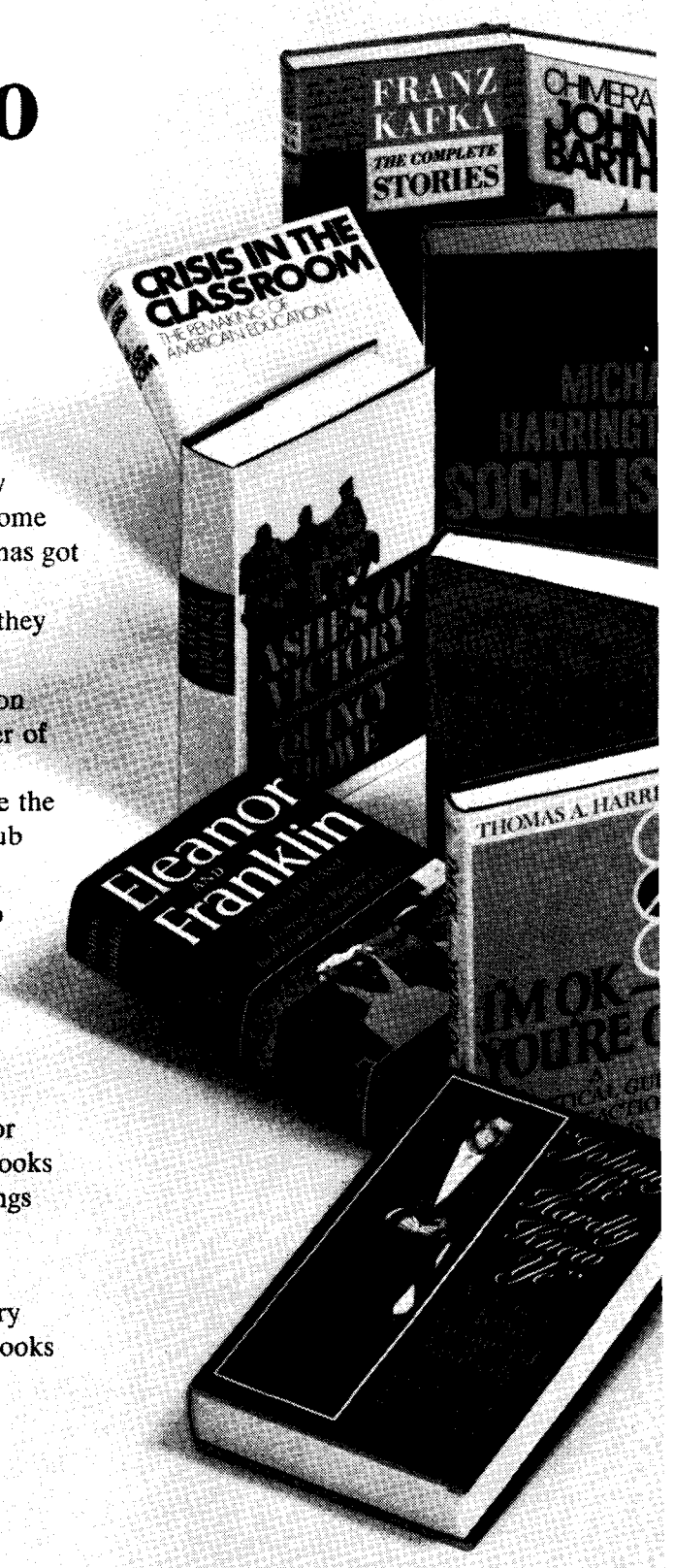

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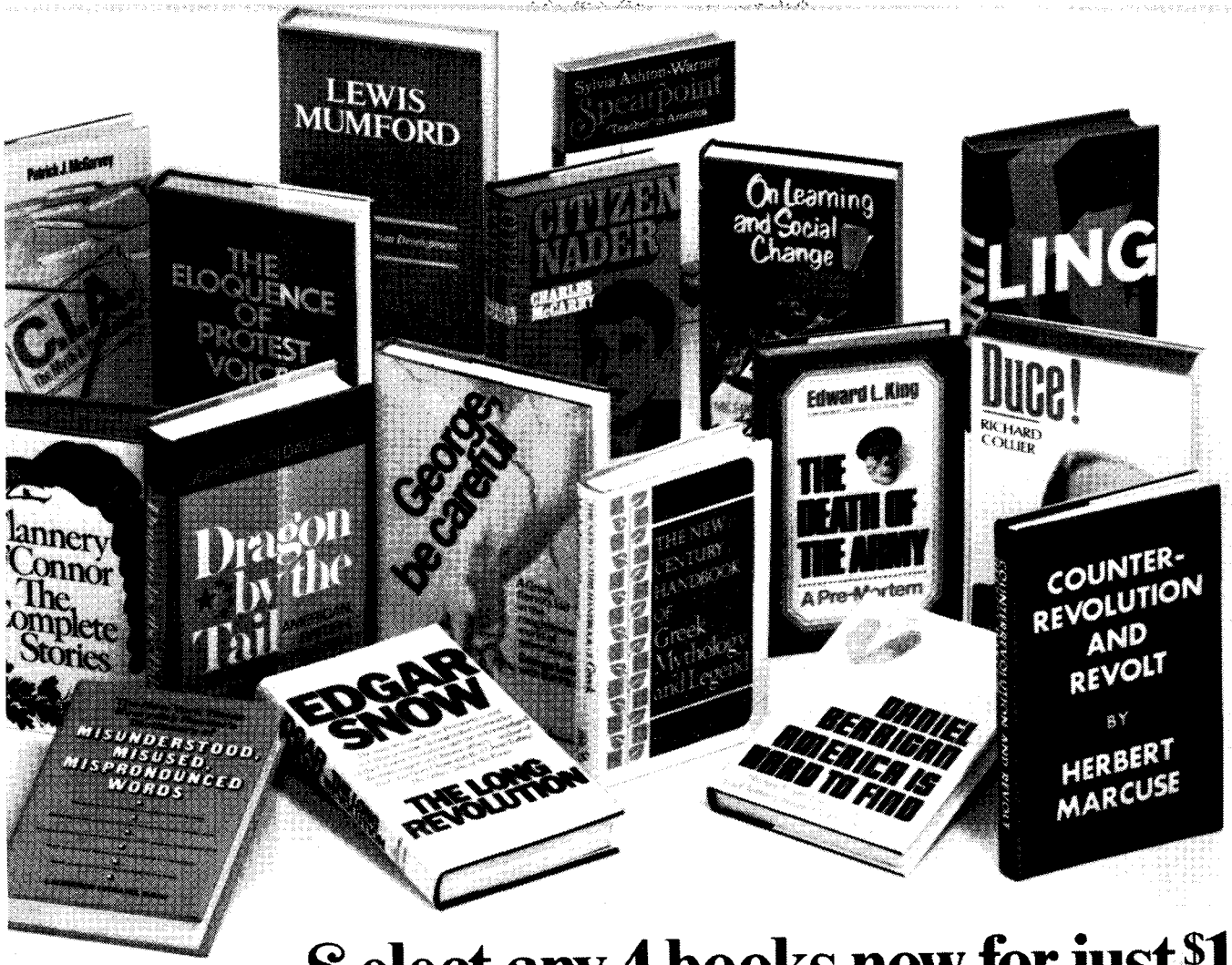

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BOOKS

The Tank, in Fact, Exploded

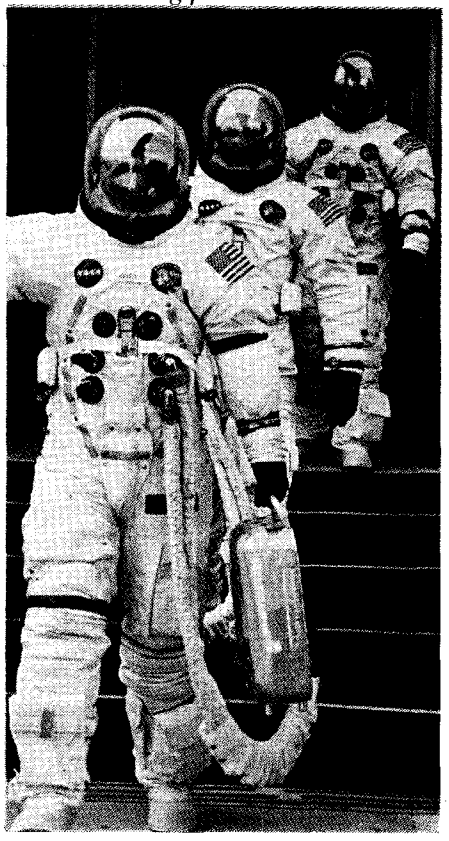
BY MELVIN MADDOCKS

THIRTEEN: THE FLIGHT THAT FAILED. By Henry S. F. Cooper, Jr. 192 pages. The Dial Press. $5.95.

What are we to make of our astronauts? Those twangy, wary men who so resemble the exceptionally fit presidents of small-town banks—those Babbitt-surrogates in space with their wisecracks and their corny moments of piety and patriotism who look out their Apollo windows and tell us, for $400 million a shot: "Boy, it sure is beautiful out there!" We are, many of us have concluded irritably, being led into the twenty-first century by nineteenth-century men.

But what then are we to make of ourselves, condescending with such bad grace toward these men who, by all the standards of courage we claim to cherish, are heroes? Treating those slow-motion dream-walks on the moon as a kind of Walt Disney fantasy package, why do we so obstinately yawn and declare our preference for the vistas of inner space?

The Apollo 13 astronauts on their way to the launching pad



There would seem to be a sort of conspiracy here, as if neither the astronauts nor we dared expose ourselves to the possibly unbalancing knowledge of what the space flights are about. We are two decades into the space age, and we are all, in one way or another, trying to evade that overwhelming fact and whatever new terrors and new responsibilities come with it.

With do-it-yourself diagrams and layman's explanations, we turn each Apollo rocket into a kind of nationally shared erector set: technology's biggest toy. Or else—what could be more demystifying? —we convert it into still another debate topic on the national economy.

When, inevitably, we have to look at the event, we are inclined to reduce its enormity to a thousand fragments. In *Thirteen: The Flight That Failed,* Henry S. F. Cooper, Jr., a meticulous and intelligent reporter, brilliantly hints at the dimensions of his subject—and then flees from them. He can describe Houston's Mission Control Center so that it seems the space age's answer to a church: "monolithic . . . as white and silent as a block of ice . . . the geometric representation of an intelligence brooding on far-off space." He can see this third lunar flight, of April 1970—a near catastrophe when one of the ship's two oxygen tanks burst two-thirds of the way to the moon—as a dramatic comment on technological *hubris*: on "overconfidently designed equipment" as well as on "the vast bureaucratic machine that had produced the malfunctioning spacecraft."

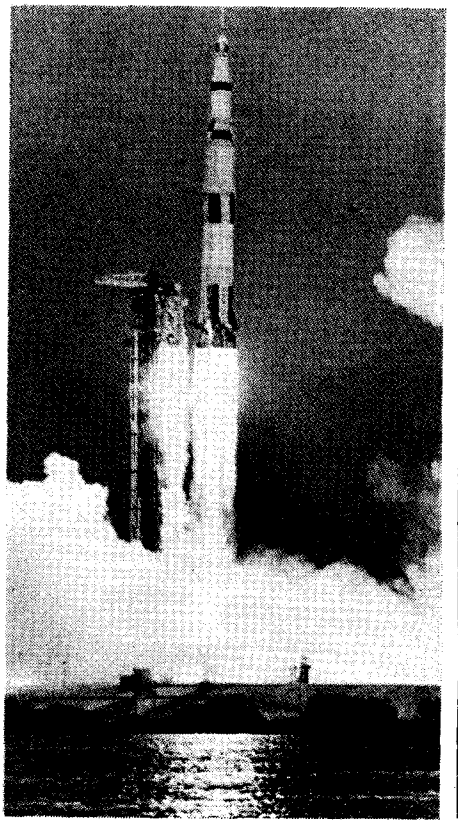
Cooper, like the rest of us, shrinks from his own broader perceptions to a tidy, linear arrangement of happenings in old-fashioned space and time—to what he quite properly calls "the anatomy of a spaceflight." Cooper's account, like his two earlier books *Apollo on the Moon* (1969) and *Moon Rocks* (1970), first appeared in *The New Yorker.* To read Cooper—cool, cursedly civilized—is to know how Moses would have written Genesis if he had been a *New Yorker* writer. An awesome event, not untouched with madness—what threatened to be "the first disaster in space"—is toned down to moment-to-moment ordinariness by sheer detail and massive common sense.

The characterizations of the astronauts are perfunctorily one-dimensional. Captain James A. Lovell, Jr., is recognizable chiefly by a certain petulance toward Houston and by the passing fact that he walked out on *Hair;* the other two astronauts are distinguished mainly by a physical feature and place of birth. Fred W. Haise, Jr.: "a slight man with dark-brown hair and a square jaw," a native of Biloxi, Mississippi. John L. Swigert, Jr.: "a sharp-faced, sharp-eyed man, who was born in Denver, Colorado." The flight controllers are even more casually identified, principally by alma mater.

Cooper has a shrewd sense for the social comedy of Mission Control. He catches the status snobbery of dynamics engineers, who refer to computer engineers as "electricians." He recognizes the territorial imperatives of specialists versus specialists—meaning that the flight controllers, who function more or less as navigators, are willing to "burn" course changes at the expense of power reserves, while those responsible for energy inventories hoard them avidly.

If Cooper would allow himself to take the risk, he clearly has things to say about the psychological, even emo-

Apollo 13 blast-off from Cape Kennedy, April 11, 1970



Melvin Maddocks is a columnist for the Christian Science Monitor; *his reviews have appeared in various magazines.*

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tional relationships of scientists to their equipment. He notes that what might appear to be the "explosion" of that oxygen tank was euphemistically called "tank failure"—that "the pressure" in Mission Control "to have confidence" in its technology was "enormous." So enormous, in fact, that thirteen minutes passed before the more than 100 flight controllers could bring themselves to accept that Oxygen Tank No. 2 had indeed experienced a "failure." For, as Cooper puts it, "the correct answer was also the unthinkable one."

Cooper ever so delicately implies a kind of computerized tragic farce. Astronauts and flight controllers, surrounded by check-off lists as big as telephone books, still inadvertently leave switches on, like careless homeowners, despite the power crisis. Even the original near-fatal error seems almost domestic in its simplicity. The oxygen tank had been damaged two weeks earlier during a test simulation, when connected to a 65-volt supply instead of the 28-volt current of the spacecraft for which it was designed.

At this point Cooper has the components—a kingdom at stake, a horseshoe with no nail—to construct at least a melodrama, if not a whole space age philosophy, out of Apollo 13. Instead, choosing almost comic understatement, he makes his comparison with, of all things, the *Titanic*.

And so, in the end, the consoles win: the ones the flight controllers monitored, the ones the rest of us watched in our living rooms. It is as if space flights are managed so that they fit on one tube or another, to the convenience of machines rather than the human imagination. The terms do not favor a writer. Even Norman Mailer, with the help of cosmological demons, has not licked the odds.

"Astronauts and flight controllers are generally uneasy," Cooper writes, "when it comes to expressing their feelings." Isn't Cooper? Aren't we all, when it comes to feelings about the space age—that triumph of the technological imagination from which our moral imagination looks away? The flight controllers of Apollo 13 could hardly contemplate their failure; the rest of us can hardly contemplate their success. □

Reason Under Siege

MIND IN THE MODERN WORLD. By Lionel Trilling. 41 pages. Viking. Paperback, $2.50.
THE TRANSFORMATION: A Guide to the Inevitable Changes in Humankind. By George B. Leonard. 258 pages. Delacorte. $7.95.

BY ALAN HISLOP

The meaning and value of rational consciousness or mind or, even more broadly, perception, have become subjects of general concern, as the interest aroused by the works of such different writers as Theodore Roszak, Charles Reich, and R. D. Laing indicates. We are no longer so certain that thinking is a good idea; we have been alerted to modes of consciousness offering alternatives to the subject-object order of perception. Some of these alternatives are obvious shucks and some are dangerous, but the outline is clear: the mind as most of us know it and try to use it to exist and to earn our livings is under siege. Perhaps the siege will prove to be only a minor skirmish, a fad, the intellectual equivalent of the hula hoop, but it is nevertheless real.

Both of these books, in markedly different ways, deal with the place that mind has in our present scale of values and the uses to which it should be put. Both agree that it is imperative for us to try to see the world and ourselves in as clear a light as possible, that is, not so much "being realistic" as finding out what reality currently is. Lionel Trilling's view of mind and its possibilities, originally delivered in 1972 in Washington, D.C., as the inaugural Jefferson Lecture in the Humanities, is essentially tragic but by no means despairing; it is firmly rooted in an intellectual tradition he is proud to be a part of. George B. Leonard, the author previously of *Education and Ecstasy* (1968), has a view that is—well, his own.

Mind in the Modern World sets out to "canvass the situation in which mind stands in our nation at the present time." Professor Trilling is not particularly encouraged by what he sees, but he is human and lucid and (dare one say it?) thoughtful. In a very few pages, necessitating a somewhat breathless dash through history, he says a great deal, particularly and very movingly when he deals with what Roszak has called (in *The Making of a Counter-Culture*) the myth of objective consciousness. Trilling's own definition of what it means to be objective, what it means to think, is a tragic one because he recognizes that no matter how hard we struggle to see and learn the truth, "it is an effort which can never wholly succeed. . . . In the face of the certainty that the effort of objectivity will fall short of what it aims at, those who undertake to make the effort do so out of something like a sense of intellectual honor and out of the faith that in the

Alan Hislop is an associate book review editor of SR.

SR. RECOMMENDS

A rotating selection by the book review editors of ten particularly notable new and current books of general interest, arranged alphabetically by title.

COLLECTED POEMS: 1951–1971. By A. R. Ammons (Norton, $12.50)—An important and absorbing collection by a renewer of the central tradition of American poetry.

THE COLUMBUS TREE. By Peter S. Feibleman (Atheneum, $8.95)—A lush new novel about beautiful people at a fashionable resort in Spain losing whatever innocence they had.

DEEPER INTO MOVIES. By Pauline Kael (Atlantic–Little, Brown, $12.95)—This huge new collection of movie reviews (1969–1972), by a critic whose writing combines intelligence, enthusiasm, wit, and clarity, serves also as a record of current interaction between movies—our national theater—and our national life.

THE FRED ASTAIRE & GINGER ROGERS BOOK. By Arlene Croce (Outerbridge & Lazard, $9.95)—An intelligent text and nostalgic photographs combine in an act of homage to the team whose grace and style have become film landmarks.

HARRY S. TRUMAN. By Margaret Truman (Morrow, $10.95)—A frank and openly affectionate biography of the former President by his daughter.

NOBODY EVER DIED OF OLD AGE: In Praise of Old People, In Outrage at Their Loneliness. By Sharon R. Curtin (Atlantic–Little, Brown, $6.95)—A powerful, personal, and affecting essay about how this country regards (and treats) its elderly, how they regard themselves, and what they might do about it.

OUR BODIES, OURSELVES: A Course by and for Women. By the Boston Women's Health Book Collective (Simon and Schuster, $8.95; paperback, $2.95)—A complete medical guide for, about, and by women, and a breakthrough book of feminine consciousness.

THE POLITICS OF A GUARANTEED INCOME: The Nixon Administration and the Family Assistance Plan. By Daniel Patrick Moynihan (Random House, $15)—This well-written, detailed account of the fate of the most far-reaching social legislation proposed since the New Deal provides a rare inside view of the workings of government and the pressure of politics.

THE TAKING OF PELHAM ONE TWO THREE. By John Godey (Putnam, $6.95)—The "impossible" hijacking of a New York subway train is the chilling event from which all else follows in this first-rate, crackingly paced suspense.

THE UNKNOWN ORWELL. By Peter Stansky and William Abrahams (Knopf, $8.95)—This first volume of a major biography of George Orwell covers the first thirty years of his life—from school days at Eton to down and out in Paris and London.

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practical life, which includes the moral life, some good must follow from even the relative success of the endeavor."

Like Professor Trilling, Mr. Leonard is in great earnest about what he is saying; but his book is rather puzzling. Subtitled *A Guide to the Inevitable Changes in Humankind*, it purports to show that "the current period is indeed unique in history and . . . represents the beginning of the most thoroughgoing change in the quality of human existence since the creation of an agricultural surplus brought about the birth of civilized states some five thousand years ago. . . . I take the term 'Transformation' to stand for both the process that spells the end of Civilization and the period during which the process takes place."

This is a serious book, written by a man whose theories on education are widely respected, but one is to some extent put off by some of the generalities: "This is no moment in history for simple reassurances" (what moment in history ever was?); by some of the windy prose: "somewhere in every consciousness the elemental vibrancy sings the inevitability of fullness"; and by some of the arguable assertions: "science fiction constitutes the most matter-of-fact report now available on recent human developments."

Leonard obviously has confidence in his own mental powers, or he wouldn't have bitten off so large a hunk —tossing out Civilization isn't something you do every day right after breakfast—but he doesn't appear to care to make use of those powers. His remarks about the corrupting influences of politics on politicians, for example, are certainly accurate, if not exactly hot news; but when he claims that things may be getting better and a new breed of elected official is beginning to turn up, he doesn't offer even a single example. Not one. Transformation or no Transformation, there is still a difference between a fact and an assertion.

Still, Leonard is not really *against* Civilization, and he isn't eager to throw the baby out with the bath water. "The new view of the universe," he writes, "by no means excludes objective observation and replicable verification, only their tyranny. The new view is not invariably clarified by the routine backward step for perspective or by the interposition of an instrument between perceiver and perceived. It is now becoming clear, as Michael Polanyi, Lewis Mumford and others have argued, that the whole concept of the detached and unmoved observer is simply a fallacy. We begin to realize that nothing is entirely impersonal. . . . To view the universe anew is to change in feeling and being."

Professor Trilling's book is conventional in manner and tone and neither promises nor delivers any startling revelations, but he believes that there is someone out there who is listening and that whatever severe limitations our minds may have, they at least provide a shared ground on which we can all stumble along together. □

SR. RECOMMENDS

SR of The Sciences *recommends the following recently published books in the sciences as being, in the judgment of the editors, particularly worthy of attention.*

ALBERT EINSTEIN: Creator and Rebel. By Banesh Hoffman with the collaboration of Helen Dukas (Viking, $8.95)—An informative and readable account of Einstein's life by a colleague who takes the sensible position that to understand the man, one should understand the works.

BLACKBERRY WINTER: My Earlier Years. By Margaret Mead (Morrow, $8.95)—Margaret Mead's story from her birth in 1901 to the outbreak of World War II—Polynesian field trips, three husbands, growing fame, and singular determination.

FREUD: Living and Dying. By Max Schur (International Universities, $20) —The physician who attended Freud during the last ten years of his agonizing illness searches for the key to the interlocking chambers between the young and the adult Freud and succeeds, in this superb biography, in demystifying and humanizing a rich and complex life.

INSECTS OF THE WORLD. By Walter Linsenmaier (McGraw-Hill, $25)—An entomological survey that is unique in its kind: sumptuously produced (160 full-color paintings and hundreds of drawings), scientifically precise, and written with poetic grace.

LICIT AND ILLICIT DRUGS. By Edward M. Brecher and the editors of *Consumer Reports* (Little, Brown, $15) —From the Consumers' Union, the compleat drug book—everything from cocaine to caffeine—with recommendations for workable drug laws.

THE SERENGETI LION: A Study of Predator-Prey Relations. By George B. Schaller (Chicago, $12.50)—A major scientific study of the life and behavior of the East African lion and its predator-rivals and prey by a leading zoologist and author of *The Year of the Gorilla* and other books.

THE TIME OF THE BUFFALO. By Tom McHugh (Knopf, $10)—A superb study of the bison in folklore and fact that is also an account of western expansion and a history of the Plains Indians.

Tooth and Claw

MAN'S AGGRESSION: The Defense of the Self. By Gregory Rochlin. 300 pages. Gambit. $8.95.

BY ROBERT SUSSMAN STEWART

No subject in the study of animal and human behavior has received as much attention in the last two and a half decades as has the subject of aggression. Ethologists, psychologists, psychoanalysts, and social scientists of nearly every school have rallied to what would appear to be an all-out attempt at bettering our understanding of the hostile actions of both man and beast.

Undoubtedly it was the cold savagery of World War II that gave rise to this flood of research activity. Are there no limits to the need to destroy each other? was the question that wrote itself on the walls of Auschwitz and in the dust of bombed-out building sites. There was a kind of hope, too, that with the new, more scientific techniques of observation and the revolutionary tool of depth psychology—largely the contribution of Freud—some real answers could be found.

In one sense there has been a degree of success. We know far more about aggression in general than we ever did before, at least in terms of raw data and in terms of aggression *after* the fact. Virtually every form of aggression in the animal kingdom, as well as in human life, has been diligently scrutinized, documented, and recorded in hundreds of projects by hundreds of workers. Yet in another sense, obviously, we have gained little if anything at all: our leaders have been gunned down, our latest war was as cold-blooded as the others, and, in truth, violence hangs in the air now almost everywhere.

Which is not to say that the search has been abandoned. In this new book by Gregory Rochlin, a Boston psychoanalyst, we have still another approach to man's aggressiveness, to those forces deep within us that lead, again and again, to hatred, to destructiveness, and to outbursts of violence. Central to Dr. Rochlin's argument is that we have been led astray by what he calls the "Darwinian legacy," namely, the idea that the behavior of animals closely parallels the behavior of men. Not really so, Dr. Rochlin asserts, and despite the continuity of the evolutionary scale, there is a crucial difference between animals and men that cannot be overlooked: that is, that man has a "sense

Robert Sussman Stewart, an editor with a New York publisher, is completing a history of psychoanalysis since the death of Freud.

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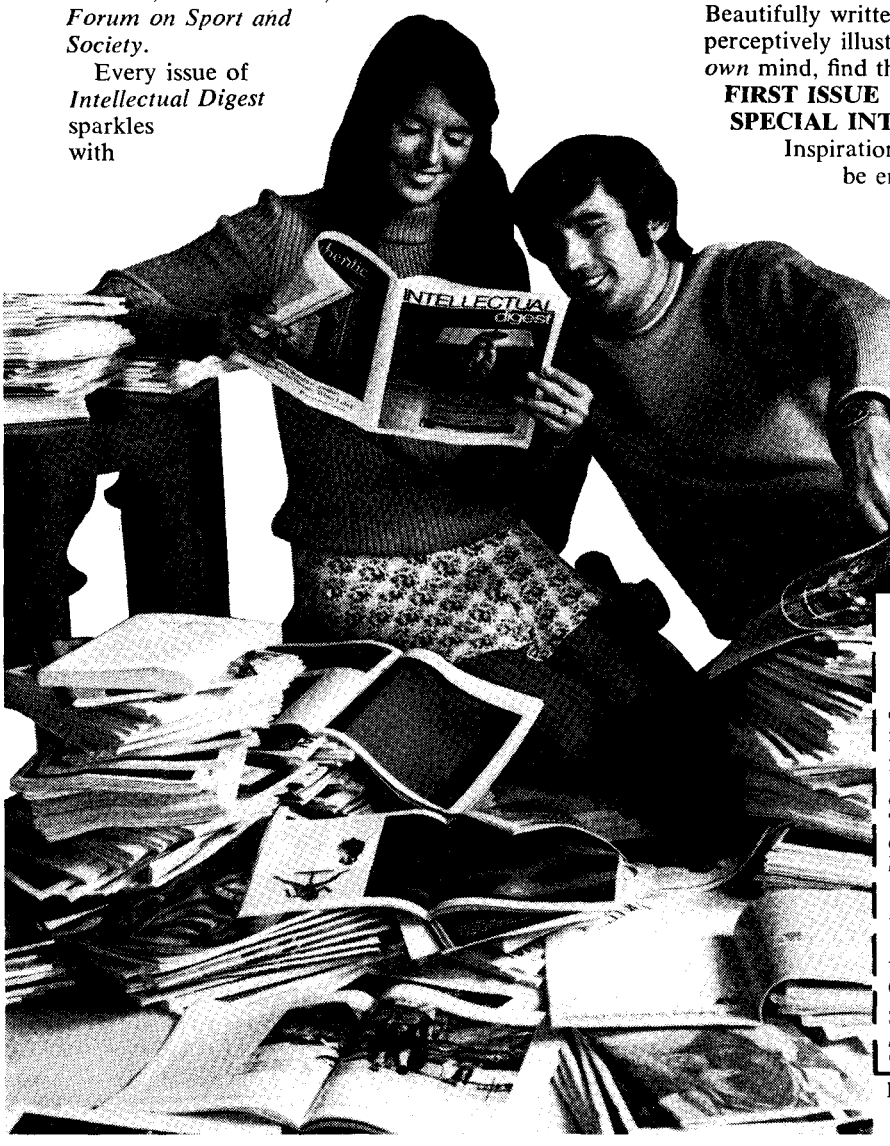

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EDITED WITH NOTES BY LINA PSALTIS

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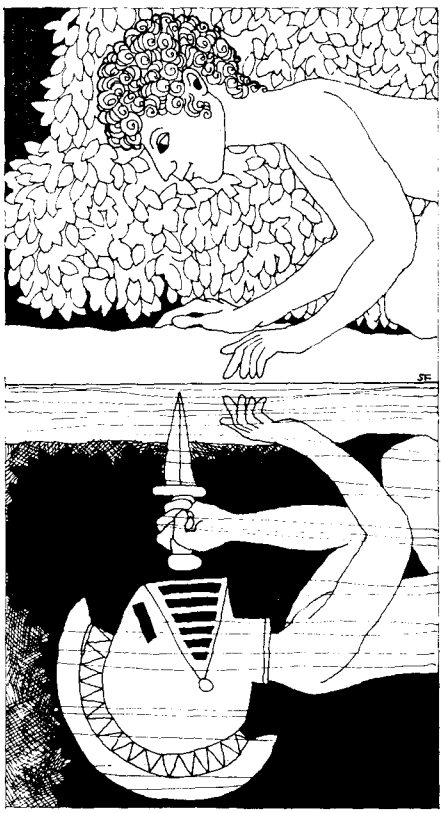
of self." It is this sense of self, this development of self-esteem, which grows out of a primary narcissism, that separates animal behavior from human behavior.

In fact, Dr. Rochlin contends that out of our narcissism comes our aggression. Specifically, if we sustain a narcissistic injury, or a loss of self-esteem, then the way we defend ourselves is to become aggressive. And it is that aggression that we turn toward others or, in some cases, toward ourselves. Only by giving up our narcissism, by coming to value others as we do ourselves, can we redirect or control our hostilities. The person who "wants everything for himself"—as is so common with young children—is the person who strikes out at those around him, who destroys human relationships both in the family setting and in a group formation.

Although this is a useful formulation, and one that Dr. Rochlin supports with clinical evidence, one is reminded of a similar notion put forward nearly seventy years ago by Alfred Adler. Adler's theory was that the "will to power," or the aggressive drive, was unleashed by feelings of inferiority—by a loss of self-esteem due to bodily injury or organ malfunction. But whether or not Dr. Rochlin's view is derivative of the Adlerian school is less important than the fact that he oversimplifies the origin, the nature, and the vicissitudes of human aggression. Furthermore, one can say the same of his notions of narcissism, a concept that is perhaps one of the most complex in the entire psychoanalytic metapsychology. While it may be constructive to emphasize the basic connection between narcissism and aggression—rather than between narcissism and sexuality, as Freud and the traditional psychoanalysts have done—it is necessary for us to know much more than Dr. Rochlin tells us about the successive stages in the building up of our sense of self and self-esteem.

How the ego grows and how we develop our earliest sense of self in and through the object world around us is at the heart of our whole character development and personality adaptation. The defenses we choose, and the self-expectations we harbor, come out of the "dark and shadowy" realm of the first year of life. Dr. Rochlin offers little detail and virtually nothing that is new in this area; he deals quite inadequately, for that matter, with the very roots of narcissism. He fails to discuss the shifts and changes in our sense of self as we go through the different phases of our lives. To ignore almost completely, for example, the outbreak of aggression during the second year of life, and its relationship to anality and anal fantasies, seems to be a serious omission.

More important, one would very much doubt that nearly *all* aggression is "reactive," triggered off by narcissistic injury. Even if this were so, there are many cases where narcissistic injury and loss of self-esteem result in an



apparent lowering of aggression and a retreat into fear and timidity. Dr. Rochlin would assert that in such cases the aggression has been turned against the self—which may indeed be true—but that leaves us without an answer to the question of why it is that aggression in some cases manifests itself as an inhibiting factor and in others becomes directed outward. What we ultimately need to know is how it is that aggression can turn one person into a helpless dependent and another into a Lee Harvey Oswald.

Unfortunately, in this area Dr. Rochlin sheds little light at all, nor does he explain what might be called "aggressive compliance"—that catalytic factor that elicits actively aggressive group behavior, as in the case of Hitler's followers. Finally, where Dr. Rochlin is most disappointing is in his suggestion throughout that any one theory can unravel so long-standing and pervasive an enigma as aggression in human life. By adopting such a notion, he falls prey to an inevitable repetition and superficiality that ironically minimizes his subject and belittles his own argument. □

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The $250,000 Question

THE FEMALE ORGASM: Psychology, Physiology, Fantasy. By Seymour Fisher. 233 pages. Basic Books. $15.

BY GENEVIEVE STUTTAFORD

Since the "discovery" of the female orgasm, the men of academia have been behaving remarkably like early prospectors; but if there is gold to be found in them there hills—and there is more than gold dust, considering that Dr. Seymour Fisher, for one, received a $250,000 grant from the National Institute of Mental Health to study female sexuality—many researchers don't seem to know where the real nuggets are buried.

Seymour Fisher, a psychologist and professor of psychiatry at the State University of New York Upstate Medical Center at Syracuse, has spent five years in studying (just how is uncertain; he is vague about his techniques) the mating patterns of 300 middle-class married women, all but one of whom are white and between the ages of twenty-one and forty-five. In addition, he has questioned each woman at length about how she *feels* about sex. Now, in the 533 virtually unreadable pages of *The Female Orgasm*, Dr. Fisher makes public the fruit of this labor—a series of muddled, unoriginal, uninformative, and often downright, even comically, questionable findings that tell us less about female sexuality than is apt to be revealed during any half hour of a feminist consciousness-raising meeting.

No less than a third of the book is devoted to a review of what appears to be—the author claims it is—*all* the empirical data available on the socialization process women are subjected to from earliest childhood (how the concept of "girl" is reinforced), and the book concludes, to the author's "surprise," that maladjustment and/or alternative adjustments to the traditional feminine role do not seem to interfere with a woman's orgasmic capacity. More of a revelation to Dr. Fisher is the fact that evidence strongly suggests that educated, assertive women have a higher orgasmic capacity than passive, docile women. What does seem to influence female orgasm—and it would appear that religious attitudes, sex education or techniques, mental stability, etc., are not important factors—is how a woman perceives her partner, the love "object" (Dr. Fisher's word). But then Dr. Fisher misinterprets this one interesting clinical finding and chooses, rather, to pursue the notion that the fault is not in what goes on in bed with the husband but actually in what a woman feels about her father.

Predictably, feminists have been extremely critical of Dr. Fisher's study, the more so since several of their enthusiastic statements (from Elizabeth Janeway and Dr. Estelle Ramey, among others) made in letters in response to a magazine summary of the book have been used, without permission, as jacket quotes endorsing the book. □

Genevieve Stuttaford is an associate book review editor of SR.

SHORTER REVIEWS

THE QUEST FOR MIND: Piaget, Lévi-Strauss, and the Structuralist Movement. By Howard Gardner. 276 pages. Alfred A. Knopf. $6.95.

While the two elder statesmen of "Structuralism"—Jean Piaget, the Swiss developmental psychologist, and Claude Lévi-Strauss, the French anthropologist—for years have been confounding, antagonizing, and, in one way or another, influencing a variety of disciplines in the study of behavior, to most laymen they are at best only vaguely familiar names. The Structuralist movement is the most interesting, challenging, controversial current approach to the social sciences; for the layman, however, it is also likely to be the most bewildering, and in *The Quest for Mind* Howard Gardner signals early on that "there is, alas, no royal road to mastery of Piaget"—which more or less sets the pace for the mental gymnastics that follow. But the author writes with such lucidity and ease that he proves to be an altogether first-class guide through the complex researches of these two scientists, whose work, with minor reservations, he says, "represents the most significant contemporary innovation in the science of man." Piaget's observations of child growth have begun to alter accepted notions about how children learn, and Lévi-Strauss, from his interpretations of kinship patterns, totemism, and myths of so-called primitive societies, draws some surprising parallels to so-called civilized so-

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ciety. Although Structuralism is difficult to define and Howard Gardner, himself a developmental psychologist, is reluctant to attempt it, he nevertheless lays a comprehensible foundation: "The Structuralists are distinguished first and foremost by their . . . conviction that there is structure underlying all human behavior and mental functioning . . . that this structure can be discovered . . . that it has cohesiveness and meaning, and that structures have generality." It's on these assumptions that Piaget, by identifying a structure of the learning process, suggests that development in children comes about in set stages that have nothing to do with age, and he cautions—to the understandable consternation of many educators—that tampering with or attempting to speed through a stage could be disastrous. Lévi-Strauss, for his part, argues that the seemingly diversified content of various cultures actually masks basic similarities. What's startling and most disputed is the conclusion of both Piaget and Lévi-Strauss, arrived at independently in their disparate fields, that man's cognitive capacity is relatively fixed, at least in the short run. How, or if, that idea will, or should, alter our way of viewing ourselves will require considerable thinking about the unthinkable.

THE CARELESS TECHNOLOGY: Ecology and International Development. Edited by M. Taghi Farvar and John P. Milton. Illustrated. 1,030 pages. Natural History Press. $25.

This collection of fifty papers presented at a 1968 conference on the Ecological Aspects of International Development, sponsored by various foundations and held in the United States, highlights (yet again) the distressing shortcomings and basically wrong-minded approach inherent in most development programs that have been and are now being mounted around the world: how, among other disruptions, the microclimate was affected by the introduction of overhead sprinkling irrigation in Israel; how the stability of the ecosystem was altered by the widespread use of pesticides on cotton crops in Louisiana; how government-sponsored social-welfare schemes, aimed at disrupting the pattern of nomadism in areas such as the Sahara, have failed to take into account the complex relationship between ecological, cultural, and economic factors. (In the Sahara, for example, the nomads' standard of living was actually higher than that of the settled population.) To date much of the technological development in health and nutrition, animal and plant productivity, pest control, and irrigation, has been self-defeating, and, in the consensus of many of the international scientists attending this conference, such development can be successful and beneficial only if based on sounder, interdisciplinary ecological planning—which reinforces the notion that the domino theory might better have been applied to nature than politics.

SMARTER THAN MAN? Intelligence in Whales, Dolphins and Humans. By Karl-Erik Fichtelius and Sverre Sjolander. Illustrated. 205 pages. Pantheon. $6.95.

No evolutionary Rube Goldberg designed the thirteen-pound brain for the elephant, a twenty-pounder for the sperm whale (which has the largest cortex in the world), and a three-and-three-quarter-pound one for the bottlenose dolphin. (*Homo sapiens*'s brain weighs in at three pounds.) According to this lively and unconventional pair of Swedish scientists, there is always cause and effect—"Birds do not fly because they have wings. They have wings because they fly"—and it follows, therefore, that species with large-size brains have them because they think and thinking is an essential function for survival. The authors quickly dismiss the correlation-of-brainweight-per-kilogram-of-bodyweight theory—on that scale *Homo sapiens* comes second to the marmoset. But relying on what little research data is available on whales and dolphins (virtually nothing is known about whales), the authors stick their necks out and answer "possibly" to the provocative question the title poses. Given this, one can only agree with their concluding plea for further research—and the sooner the better, if we're to head off such random pebbles skimming over the surf. □

Better Mousetraps

A CENTURY OF WONDERS: 100 Years of Popular Science. By Ernest V. Heyn in collaboration with past and present editors of Popular Science Monthly. Illustrated. 320 pages. Doubleday. $20.

This book might have been more properly subtitled, "100 Years of Popular Technology," since it is concerned almost exclusively with inventions that have changed our lives over the past century. Divided into chapters such as "The Horseless Carriage Grows Up," "The Phonograph: From Tinfoil to Tape Deck," and "Military Science—From Cannonballs to ICBMs," it's an unabashed celebration of gadgets and products, whipped up in honor of the 100th anniversary of *Popular Science Monthly*. Having brought the technological good news into American living rooms for so long, the editors have a wealth of nostalgic material to draw on, and the result is almost irresistible fun, illustrated with nearly one thousand photographs and drawings, all of them suggestive of the inky, coarse publications of one's childhood. They inevitably evoke the time when people actually tinkered with jalopies and crystal radio sets (indeed, there is a chapter on Do-It-Yourself), partly because the whole book has a Buck Rogers air about it (a favorite word is "amazing") and the style, particularly in the captions, is of the staccato journalese (many exclamations, few articles) popular thirty years ago. The contents have the curiosity value of an old Sears catalogue—cumbersome cameras, records made of resin-coated paper, running boards, the first toothpaste tubes—but the overall effect is to make us reflect on how very recent so much of our now-standard technology is: every reader will come across scores of commonplace products that were hailed as miracles in his own lifetime. And the tone—breezy, simple, and outlandishly enthusiastic—has a curiosity value in itself, now that the wonders of technology are under question everywhere. In the caption under a photograph of a plastic heart, the editors conclude their transplant account with: "Only 1 in 7 patients survived very long. The big problem was the body's rejection of a foreign object. Drugs and serums helped. Research goes on." J.K.

Popular Science *cover for November 1921*

Answer to **Literary Crypt**, page 12:

How wonderful opera would be if there were no singers.

Rossini

Answer to **Wit Twister**, page 12: lamber, ramble, ambler, marble, blamer.

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MUSIC

The Two Worlds of Zubin Mehta

BY IRVING KOLODIN

The current consensus that chronology determines the affinities of an interpretative musician has been shaken, unsettled, and dislocated by the kind of career that Zubin Mehta is carving out for himself as conductor of the Los Angeles Philharmonic. A visit to the Music Center in early February for a miscellaneous program in which Daniel Barenboim was the piano soloist suggested that, for a conductor born in the mid-Thirties, Stravinsky's *Pulcinella* should be his closest affinity.

Such, however, was not the case. It was a program warmed, burnished, and glorified by a performance of Strauss's decades earlier *Don Quixote*. Here Mehta's conditioning had to be given precedence over his year of birth. As the first major maestro to emerge from the subcontinent of India, Mehta was magnetized to post–World War II Vienna, where the long midnight sun of romanticism still cast a flickering glow.

This performance of *Don Quixote* was, in a way, the closing of a circle that began for Mehta when he substituted for the late Fritz Reiner as conductor of the Los Angeles Philharmonic for a program that included the same work on January 19, 1961. The cello soloist was once again Kurt Reher, who demonstrated a command of both the instrument and its Straussian function, which put him in a category high above the average of orchestral section leaders. He faltered only momentarily, in a totality of excellence, when in the very last passage his bow left the string seconds too soon and the Don expired in silence rather than with a sigh. The orchestra's solo violist, Jan Hlinka, impersonated Sancho Panza with a fidelity that merited Reher's warm embrace at the end.

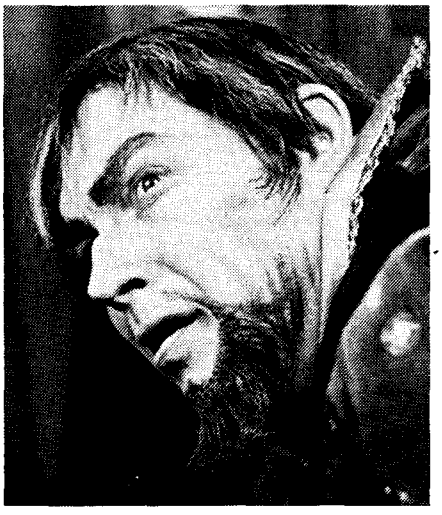
In this context of massive requirement from a full complement of the orchestra's performing personnel, Mehta functioned at maximum efficiency. Section playing was crisp, and the cello ensemble backing the soloist was given proper prominence, something that seldom happens. The greater the curiosity, then, that a much smaller group of players gave an evening-opening performance of *Pulcinella*, Stravinsky's first neoclassical masterpiece, that was ill disciplined, poorly balanced, and none-too-well motivated.

Motivation should begin with the premise that the dance impulse in such a ballet score as *Pulcinella* must be preserved, even in a concert-hall performance. In a sequence of sections including a "Tarantella," "Gavotta," and "Minuetto," the emphasis was all too heavily on the earthbound rather than the airborne. Intonation was approximate rather than exact; the weaker instruments—especially woodwinds and horn—rarely were given easy access to the listening ear.

Barenboim and Mehta are the best of musical friends and have often collaborated effectively. This time their performance of the Beethoven C-minor Concerto did not seem to be one of those occasions. On the superficial level it was an assertive, well-coordinated playing of Beethoven's Third Concerto. Those acquainted with its more profound values had to accept Mehta's overacting as the equivalent of drama and Barenboim's carefully constructed phraseology in place of poetry. Mehta's world continues to be divided between the repertory in which he has traditionally excelled (Strauss) and that which continues to elude his comprehension.

During his debut at the Metropolitan Opera playing the title role of Verdi's *Rigoletto*, Ingvar Wixell moved ahead, act by act, to a statement of the role that was vocally solid, musically sure, and artistically valid. What the effort of the Swedish baritone lacked was perhaps something beyond his capacity to give: Verdian fervor, Italianate eloquence, Mediterranean warmth.

Ingvar Wixell—ready and able



Such qualities are not necessarily congenital: Wixell's great countryman Jussi Bjoerling met most Italian contemporaries on even terms, as Birgit Nilsson does today in some of her specialities. Perhaps if Wixell settles down at the Met and performs with international colleagues even more regularly than he has in San Francisco, that impetus will accrue to him also. Certainly the voice has some special characteristics worth noting: a particularly brilliant top and a good, firm bottom. In between it isn't quite as vibrant as it might be. But it is ready and able for the kinds of male service the Metropolitan repertory can always use.

In place of the announced Reri Grist, Gail Robinson was offered as Gilda, and Enrico di Giuseppe accepted the challenge of performing the duke when Luciano Pavarotti was unable to appear. Miss Robinson has undoubted talent, a pretty voice, and a secure technique, but her sound, after she had been ravished by the duke, remained as virginal as before. She has not yet attained a point of progress where she can forget her schooling and identify with the character she is portraying. That, certainly, should be a precondition to an engagement as a performer of leading roles at the Metropolitan. As for di Giuseppe, he responded manfully to the task of replacing a reigning favorite and performed to the best standard of which he is capable—with a light lyric sound, artfully controlled and sensitively shaped to the music he was singing. The vulgarians who booed his "Parmi veder" because it wasn't equal in size and vibrance to Pavarotti's were overwhelmed by the majority of listeners. Indeed, acting manager Schuyler Chapin should have announced the altered casting himself and accepted the audience reaction, unpleasant as it might have been, rather than delegating it to a subordinate.

James Levine made his presence felt more than the customary conductor of *Rigoletto*, but not always to the end of a unified performance. Energy is not invariably the equivalent of momentum, nor is vigor to be equated with drama. Almost all his tempos were too fast for vocal equilibrium, the emphasis on brass and percussion better suited Bayreuth than Mantua. He has much to give, but also much to learn. Quickly, if possible. □

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FILM

Three Swipes at the Establishment

BY ARTHUR KNIGHT

The Establishment, the roots of power, can be attacked in many ways—with anger, moral indignation, satire, or, on rare occasions, with humor. *Steelyard Blues*, written by David S. Ward, appears bent on attacking on all fronts and in all styles simultaneously. If it seems like a second cousin to *M*A*S*H* (a relationship emphasized by the unflappable presence of Donald Sutherland), that is because it shares not only that film's mordant sense of the ridiculous but much of its anger as well.

Perhaps because its targets are somewhat less incendiary than those of war, killing, and the military brass taken on by *M*A*S*H*, *Steelyard Blues* emerges as less irate than its predecessor, although it still breathes considerable fire from its nostrils. All of it is directed against Establishment types, embodied by Howard Hesseman, an ambitious district attorney whose political aspirations are constantly being jeopardized by the freewheeling antics of his free-swinging brother (Sutherland). The fun begins when, for political reasons, Hesseman has his brother released from jail and finds him a job feeding the animals at the municipal zoo. His brother's first act of freedom is to climb the gingerbread facade of a stately mansion to call on his girl friend, a $100-a-trick prostitute (Jane Fonda), after which he promptly gets himself fired from the zoo for climbing into its cages to feed the lions.

His dream, quite literally, is to fly off into the wild blue yonder with some of his equally offbeat friends. They take over an abandoned naval seaplane and, between jousts with the authorities, proceed to patch it up with junkyard bits and pieces. Although they think nothing of a little petty larceny to finance the operation, they are eventually forced to resort to grand larceny when a nearby naval depot proves the only source for the necessary precision controls for the cockpit. Even so, the gang elaborately prepares its commando-like heist without bloodshed and with a minimum of mayhem and a full quota of laughs. Finally, the plane is on the runway, revved up and ready to go on its unchartered, uncharted, round-the-world flight in search of a place where people can work together for the joy of accomplishment and live together in a spirit of harmony. When, led by the district attorney, battalions of police arrive to put a halt to the flight, the audience's sympathies can only be on one side.

As in *M*A*S*H*, the core of the film is considerably more sober than the telling. The bald Peter Boyle, wearing a variety of zany wigs, is a sheer delight as one of Sutherland's more antic cronies—particularly when he unaccountably launches into a leather-jacketed Marlon Brando impersonation. Jane Fonda, in a frizzy hairdo, seems to be repeating her *Klute* role, but this time with an impishly light touch and a neat sense of comedy timing. But Sutherland, his pale eyes glittering with a manic delight at each new embarrassment he can create for the powers that be, is the screwball center of this curious essay, and he is always supremely certain of the proper tone to prevent its becoming either preachy or paranoid. Credit also Alan Myerson, formerly of San Francisco's satiric company The Committee for a directorial job that has much of the lunatic verve of the old Marx Brothers comedies, and Nick Gravenites (among others) for a lilting rock score that not merely underlines the humor but expands it. If the plot gets a mite untidy at times, at least *Steelyard Blues* remains a comedy you can laugh at without hating yourself in the morning.

In its own way, *Baxter!* is also critical of authority—in this instance the unbridled authority of parents over their children. Baxter, touchingly performed by young Scott Jacoby, is the son of divorced parents—a father who tends to disparage him mainly for his childish substitution of *w*'s for *r*'s and a mother who couldn't care less so long as the boy doesn't interfere with her pleasures. Matters are hardly improved when, transplanted to London, he falls into the hands of a sadistic teacher who mocks his manner of speaking. Inevitably, the boy turns rebellious—motivated in part by an infantile desire to attract attention, but also because he is mature enough to recognize and resent injustice. Not even the wise counseling of a sympathetic speech therapist (Patricia Neal) or the open affection of two neighboring lovers (Jean-Pierre Cassel and Britt Ekland) can make up for his parents' lack. The alienation increases until, in a terrifying scene, the boy sinks into a complete catatonia, while mother and therapist battle over who can save him.

Though all of this may sound inordinately grim, it isn't. Lionel Jeffries, who earlier directed *The Railway Children*, seems to have a special touch with young actors, capitalizing on their youthful appeal without exploiting or sentimentalizing them. And Reginald Rose's script, with its strong characterizations and compact scenes, manages to evoke the radiance of childhood and the exuberance of youth so tellingly that there is an added poignance when all the radiance and exuberance of this particular youth, Baxter, are snuffed out by his well-intending but unfeeling parents. Lynn Carlin is especially effective as the hysterical mother, even though Jeffries's penchant for the extreme close-up often results in overemphasis. The main thing, however, is that by the end of the movie you care desperately for Baxter and only wish he could have chosen his parents more wisely.

Child's Play, on the other hand, takes quite a different view of authority. The brusque, cold, strict disciplinarian, played by James Mason (in a performance that, at the very least, should win him an Academy Award nomination), uses his authority to protect his young charges at a Catholic boys' school against some very real but unspecified evil that is turning them into sadistic and sacrilegious monsters. In his Latin classroom Mason is an unbenevolent despot. At home, tending his dying mother and shielding her from obscene telephone calls, he reveals his true vulnerability and courage. On the other hand, there is bluff, hale, popular Robert Preston—everybody's idea of what a good teacher should be.

Unfortunately, Leon Prochnik's script, based on the play by Robert Marasco, never quite makes clear whether the boys' acts of sadism are due to simple malevolence or a kind of occult Satanism. If the film fails—as it ultimately does—it is primarily because the script tries to have it both ways, creating scenes for immediate effect rather than overall consistency. And Sidney Lumet's direction follows Prochnik's lead. It is taut, chilling, and suspenseful but lacks a point of view. He creates a mood but not an intent. When Mason flings himself off the roof of the school, does it mean that the forces of evil have won out? Or when Preston gathers together his books to leave the school, has goodness finally triumphed? *Child's Play* supplies no answers—just plenty of nerve-tingling moments along the way. □

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(Continued from page 73)

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ORIGIN OF LIFE SEMINAR, dealing with current speculations, to be held in southern California area Saturday, April 7th. Contact: Gary Hareland, 21726 West Placerita Canyon Road, Newhall, California 91321.

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RENT-FREE VACATIONS. Write Holiday Home Exchange, Box 555, Grants, N.M. 87020.

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APARTMENTS FOR SALE

Furnished

5th AVENUE AND 61st STREET, NYC. At $295,000 (price just reduced) it's a bargain. On the 40th floor of the Pierre Hotel, with sweeping views of the Park and the City.

MAGNIFICENTLY FURNISHED. Exquisite details throughout; marble floors and baths. Custom stereo system and variable custom lighting throughout.

LARGE LIVING ROOM, dining room or library, corner master bedroom, 2 fully equipped kitchens, powder room, bath. A sauna. Maintenance $1,350 monthly. Brokers protected. SEEING IT IS UNFORGETTABLE.

Wm. A White & Sons, Lillian Ross, 51 East 42nd Street, New York, N.Y. 10017. Tel. 212-682-7559 or 4515.

MADRID. Paneled fireplace, terrace, service porch, 3 bedrooms. Five minute walk to shops, cafes, cinema. $15,500 furnished. SR Box J-977.

PROPERTY FOR SALE

ONE OF THE MOST UNUSUAL AND SPECTACULAR homes in San Diego County, located approximately 4 miles southwest of Rancho Santa Fe, is now available because the owner has moved to the East. This new contemporary designed residence contains approximately 3,900 square feet on 4 different levels, consisting of a recreation room which is located on the lower level along with a full bath, a fireplace and a kitchenette, a main floor consisting of a living room with 22 foot ceilings, a dining room with stained glass windows and an adjoining patio and kitchen with every modern convenience, a master bedroom on its own private floor with a spacious bath, dressing room, fireplace, and two balconies from which one can see the ocean to the west and the mountains to the south and east. Finally, on the top floor there are 2 bedrooms and a bath along with 2 studies which could be converted into 2 bedrooms.

THE POOL is surrounded by real and imitation boulders and has every imaginable facility including high and low diving boards, waterfalls, slides, outdoor barbecue, wet bar, and snack bar as well as two unusual cavern-like dressing rooms (the owner has invested over $100,000 in this area alone).

A RECESSED LIGHTED TENNIS COURT with dressing rooms is located a short distance from the house and to the south are stables large enough for boarding three horses but which are readily expandable.

THERE IS ALSO A SMALL HOUSE consisting of 2 bedrooms and a bath, which could be either servants' quarters or a guest house with certain renovations.

THERE ARE 17 ACRES which would be difficult to surpass in beauty and strategic location because of the magnificent view of the ocean and the mountains, along with a rolling green lawn and beautiful gardens with towering eucalyptus trees. This is a truly unforgettable estate in which the owner's investment is $585,000. The asking price is $495,000. Liberal financing is available.

ROBERT K. SMITH, Realtor, 7911 Herschel Avenue, La Jolla, California 92037. 714-459-4471.

WESTHAMPTON BEACH, LONG ISLAND—Prime location. Exquisite oceanfront property—220' on ocean. Thickly landscaped for complete privacy. High dune with beautiful view. $150,000. Jean Carbone, Real Estate Broker, 516-653-4197.

NORTHERN VERMONT REAL ESTATE. Brooks H. Barron, Kent Mitchell, Realtors, Hyde Park, Vermont 05655. 802-888-4287/2433.

CALIFORNIA'S GOLD COAST—Del Mar—surf view acreage. 15 acres, zoned multiresidential and commercial. 15 minutes to beautiful San Diego Bay, Beaches, Boating. Horsemen's Paradise. Best climate in United States. Property is 5 minutes to UCSD campus, Gulf General Atomic, new VA Hospital and many new industries, and beautiful La Jolla. Surf, Ocean and Torrey Pines State Park Views—UNIQUE. These parcels are available separately or together. Write or call for information and brochure. McKellar & Wyer, Inc., Realtors, 1202 Camino Del Mar, Del Mar, California 92014, Phone Area 714-755-9318, Mr. Robinson.

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INTERESTED IN OWNING A FRANCHISE?—Business of your own, or full- or part-time money-making opportunities? Find out what's available. Send name for FREE 5-month subscription to Salesman's Opportunity Magazine, Dept. 1176, 1460 Hancock Center, Chicago, 60611.

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HAS YOUR TEENAGER OUTGROWN "CAMP?" Vagabond Ranch, Granby, Colorado, provides superb western experience. 27th summer. Boys, girls 11-17. Also March Ski Camp at Vail. Charles D. Pavek, Washington, Connecticut 06793.

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THE HAGUE SUMMER MUSIC CENTER offers music, sightseeing, sports, international atmosphere. Total beginners and advanced players. Coed 9-16. Haagsestraat-38, 's-Gravenhage, Holland.

KINIYA—a camp for girls, 6-17, on a bay of Lake Champlain in Vermont. Excellent riding, own stables, miles of lovely trails on camp property, dressage, jumping, hunting. Responsible, experienced staff. All camp activities including water skiing, sailing, tennis, drama and dance. Outpost camp for overnights in Stowe. Special program for older girls includes 3 weeks in Ireland, 3 weeks in Vermont. A happy relaxing summer. Mr. & Mrs. J. R. Williams, Camp Kiniya, Milton, Vermont 05468. Tel. 802-893-7849.

DRAMA, MUSICAL COMEDY, Dance, Art, TV, Filmmaking—Public Performances, Sports. Nation's foremost summer training center, featured article in N.Y. Times—on Lake Sunapee, N.H. Coeducational. 10-18. 8 weeks, $1,195. Beginners Showcase Arts Center, Dept. 14G, 240 East 76th Street, NYC, 10021. 212-249-9288.

BROWN LEDGE—Mallett's Bay, Vermont, "One of America's finest camps." Girls 10-18. Free daily riding for all. Finest show horses, mounted lance drill, jumping. Sailing, racing tactics; water skiing, drama, swimming, tennis, golf, archery, riflery, crafts, trips. No extras! "The Complete and Different Camp." For booklet, state age and write to winter office: Miss Barbara Brown Winslow, 155 Dodds Court, Box C, Burlington, Vermont 05401.

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CAMPS

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VACATIONS

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VACATIONS

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KINGSLEY DOUBLE-CROSTIC

Reg. U.S. Patent Office

By Janet Elliott Cameron

No. 2028

DEFINITIONS	WORDS
A. Whitewash	82 168 115 16
B. Different	143 90 178 70 11 34 154 49 83 169
C. Unit of weight equal to 1,000 pounds	146 182 81
D. Axilla	93 164 85 153 79 56
E. Infant vehicle	35 43 94 151 139 113 176 145
F. Leave	175 12 106 152 136 29 50 144 52 127
G. Town in Massachusetts, site of Tanglewood, where summer music festivals are held annually	102 54 13 125 156
H. Unfortunate condition, chiefly in children, usually resulting from a brain lesion	86 30 78 155 181 91 57 170 96
I. Tropical disease characterized by an eruption of raspberry excrescences on the skin	7 121 9 161
J. Pass on	112 179 142 28 37 14 87 166
K. Exclude by general consent	172 80 95 15 31 180 157 75 88
L. Site of Cornwallis's surrender to Washington	38 10 177 138 158 148 92 55

DEFINITIONS	WORDS
M. U.S. actress and author: *Our Hearts Were Young and Gay*	32 101 116 137 122 160 51
N. Unsophisticated	163 65 108 2 19 58 69
O. Gentile (comp.)	184 23 124 27 64 134
P. Fine porcelain (2 wds.)	33 149 46 8 53 76 26 150 48 159 36 132
Q. Lay claim to	1 135 183 62 129 39 89
R. Old-time actor: *All Quiet on the Western Front* (2 wds.)	133 167 97 20 4 111 25 117
S. Antagonistic in purpose	40 77 171 103 130 141 110
T. City in W. central Mississippi on river of same name (2 wds.)	174 3 45 59 105 17 72 128 84
U. Glee	24 140 98 173 42 162 114 21 73
V. Important ancient Philistine city, early center of Christianity	67 104 60 47 6 123
W. Slender	165 66 99 41 71 126 120 109
X. Dignify	61 100 131 107 5 18 119
Y. Brutishly gross or sensual	147 22 44 63 74 68 118

DIRECTIONS

Don't let the definitions scare you. If you can guess five or six of these WORDS correctly, you should be able to solve the Double-Crostic . . . . When you've guessed a WORD, fill in the dashes, and also write each letter in its correspondingly numbered square in the diagram. When all the squares are filled in, you will have a quotation from a published work. Dark squares indicate the ends of words. If there is no dark square at the right side of the diagram, the word carries over to the next line . . . . You should be able to see words and phrases begin to form in the diagram on the basis of having just a few letters. Enter the letters you can guess into the diagram and the blanks in the defined WORDS, and you'll find yourself working from WORDS to diagram and back, solving the puzzle. . . . The initial letters of the defined WORDS spell the name of the author and the title of the work from which the quotation was taken. This acrostic feature can be very helpful to the solver.

		1 Q	2 N	3 T	4 R	5 X	6 V	7 I	8 P		9 I	10 L	11 B	12 F	13 G	
14 J	15 K	16 A		17 T	18 X	19 N	20 R	21 U		22 Y	23 O	24 U	25 R	26 P		27 O
28 J	29 F	30 H		31 K	32 M		33 P	34 B	35 E	36 P	37 J	38 L		39 Q	40 S	41 W
42 U	43 E	44 Y	45 T	46 P	47 V		48 P	49 B	50 F		51 M	52 F	53 P	54 G	55 L	56 D
57 H		58 N	59 T		60 V	61 X	62 Q	63 Y	64 O	65 N		66 W	67 V	68 Y		69 N
70 B	71 W	72 T	73 U	74 Y	75 K	76 P	77 S		78 H	79 D	80 K		81 C	82 A	83 B	84 T
85 D	86 H	87 J	88 K	89 Q		90 B	91 H		92 L	93 D	94 E	95 K	96 H		97 R	98 U
99 W	100 X	101 M	102 G	103 S	104 V		105 T	106 F		107 X	108 N	109 W	110 S	111 R		112 J
113 E	114 U	115 A	116 M	117 R	118 Y	119 X	120 W		121 I	122 M	123 V		124 O	125 G		126 W
127 F	128 T	129 Q	130 S	131 X	132 P	133 R		134 O	135 Q	136 F	137 M	138 L	139 E	140 U	141 S	
142 J	143 B	144 F	145 E	146 C	147 Y		148 L	149 P		150 P	151 E	152 F	153 D	154 B	155 H	156 G
157 K	158 L	159 P	160 M	161 I		162 U	163 N	164 D		165 W	166 J	167 R	168 A	169 B		170 H
171 S	172 K	173 U	174 T		175 F	176 E	177 L	178 B	179 J	180 K	181 H	182 C	183 Q	184 O		

Solution of this issue's Double-Crostic will be found on page 69

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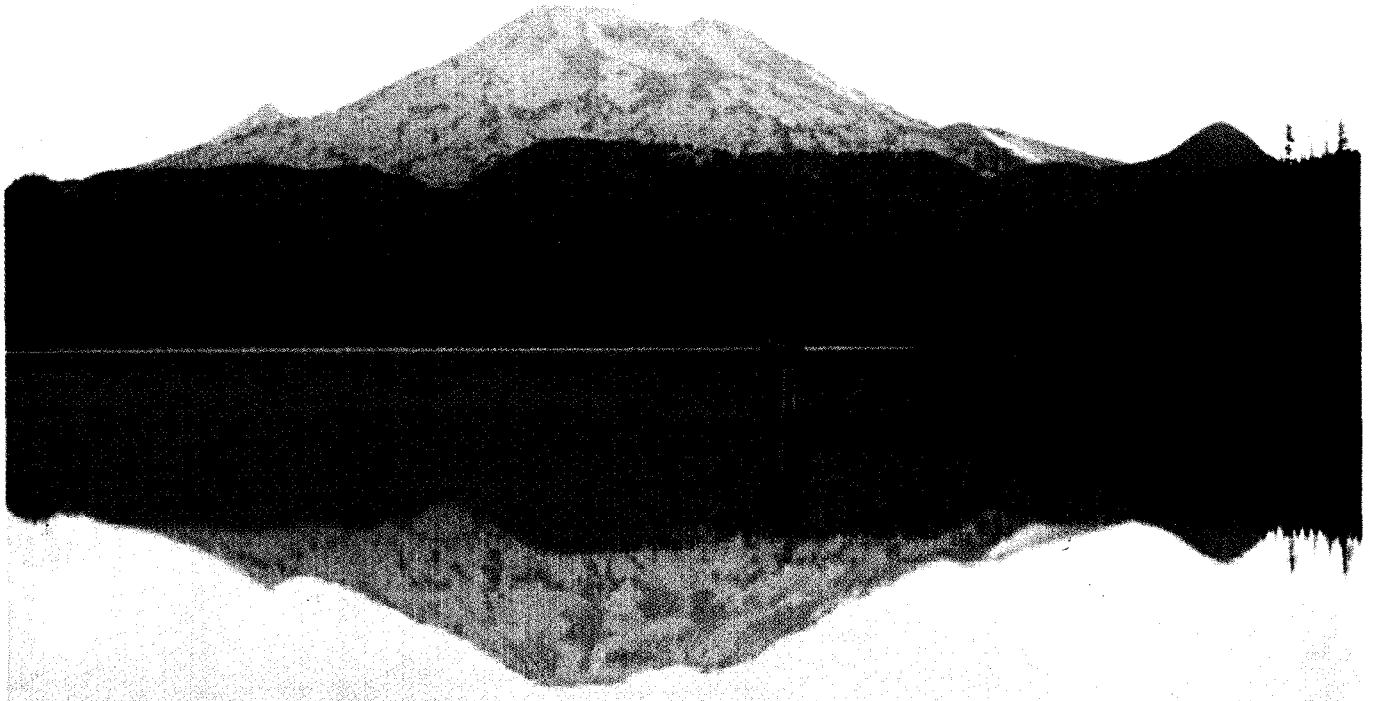

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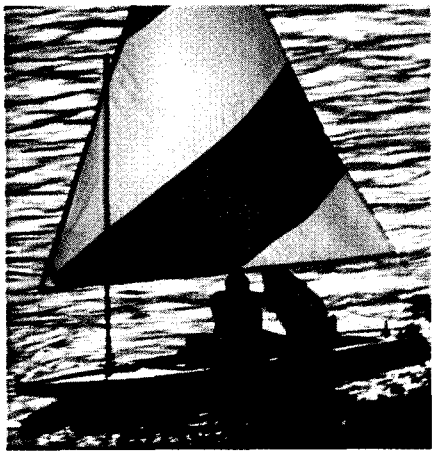

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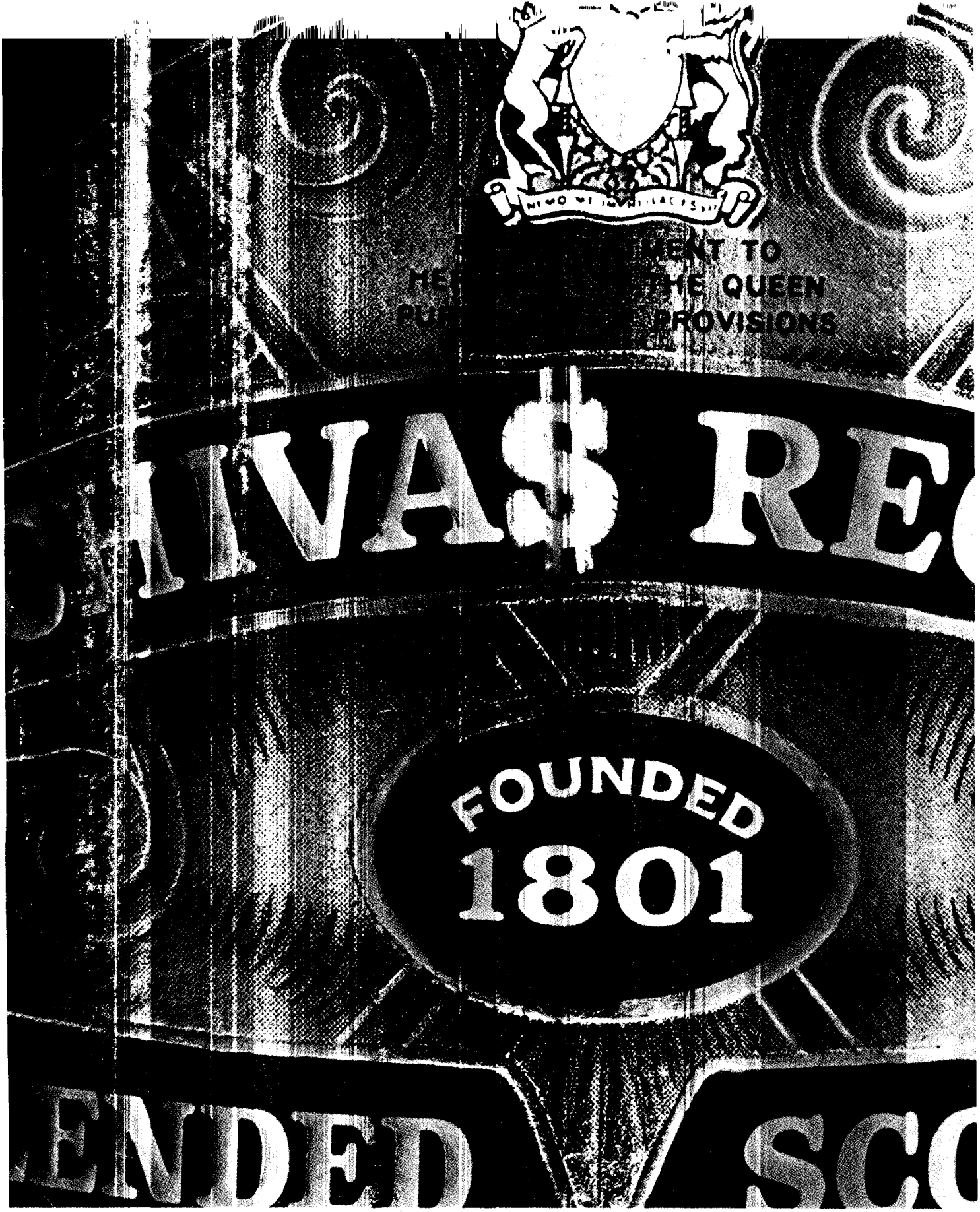

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